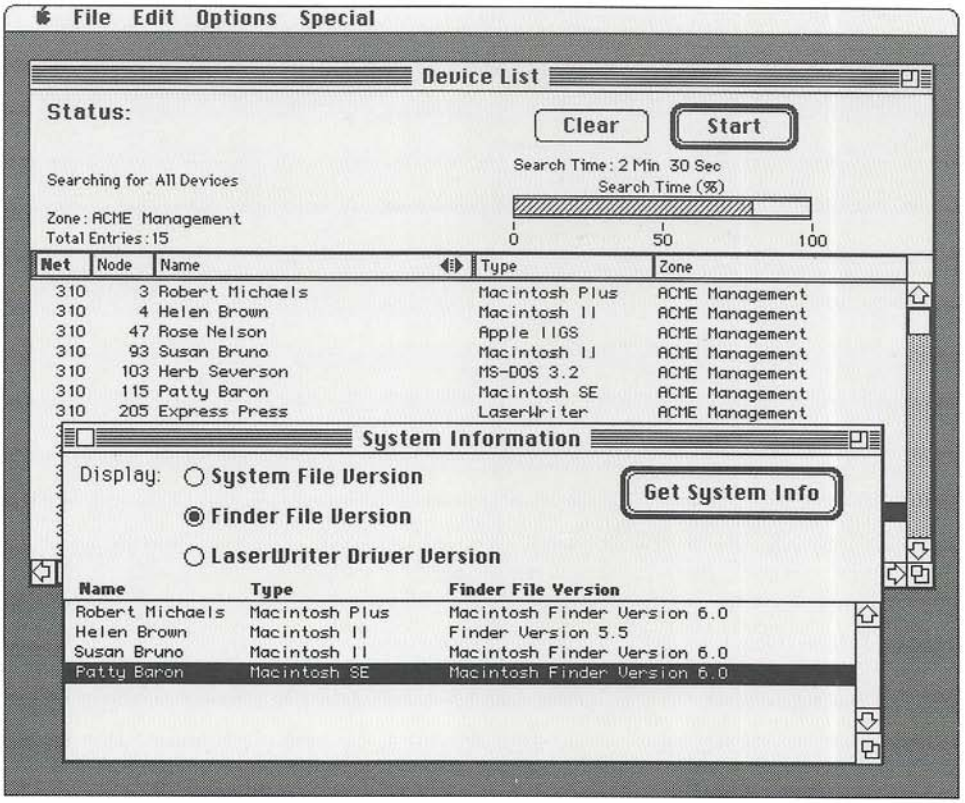
Apple® Inter•Poll™ Network Administrator's Guide


File Edit Options Special
Device List
Status:
Clear
Start
Searching for All Devices
Search Time: 2 Min 30 Sec
Search Time (%)
Zone: ACME Management
Total Entries: 15
0
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Net Node Name Type Zone
310 3 Robert Michaels Macintosh Plus ACME Management
310 4 Helen Brown Macintosh II ACME Management
310 47 Rose Nelson Apple IIGS ACME Management
310 93 Susan Bruno Macintosh II ACME Management
310 103 Herb Severson MS-DOS 3.2 ACME Management
310 115 Patty Baron Macintosh SE ACME Management
310 205 Express Press LaserWriter ACME Management
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Display:
System File Version
Finder File Version
LaserWriter Driver Version
Get System Info
Name Type Finder File Version
Robert Michaels Macintosh Plus Macintosh Finder Version 6.0
Helen Brown Macintosh II Finder Version 5.5
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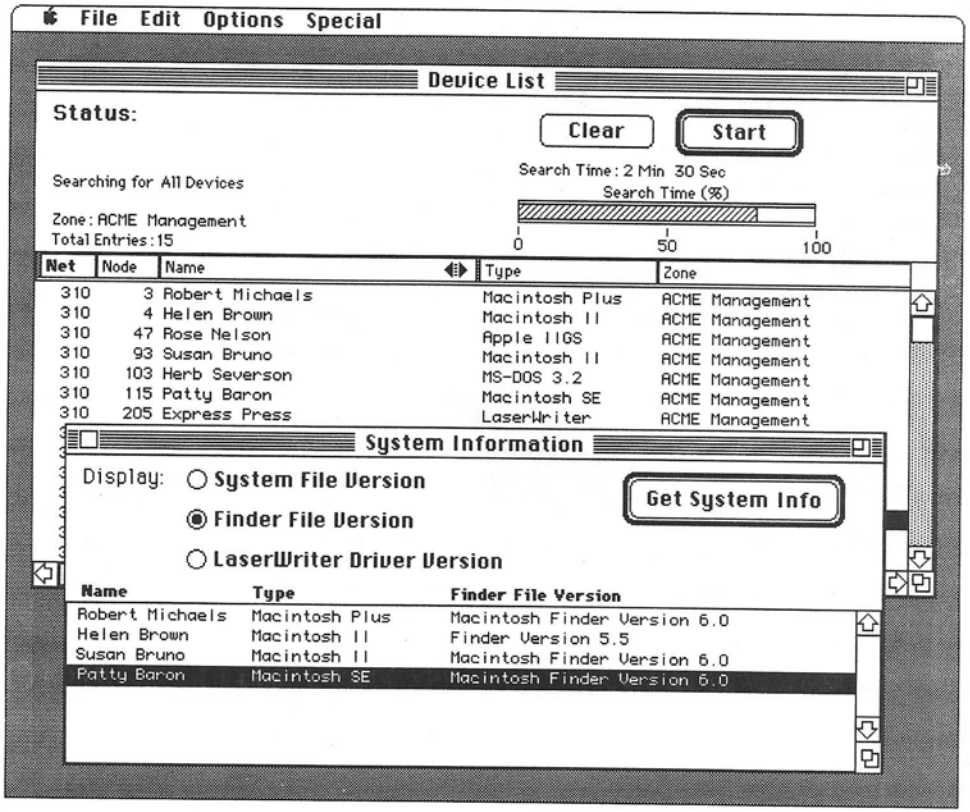

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Tell Apple card

Preface

The Inter•Poll™ Network Administrator's Utility is a software tool that searches for and reports on the active devices—such as workstations, printers, and file servers— connected to an AppleTalk® network system. The information reported by Inter•Poll can help you to locate, analyze, and solve communication problems on your network. Inter•Poll can:

- display customizable listings of network zones, connected networks, and active network devices
- verify the connection status of any part of a network or internet (multiple networks joined by bridge devices), to help respond to user problem reports
- localize possible sources of trouble and provide troubleshooting guidelines to pinpoint problems
- query active workstations in an AppleTalk network system for a report of currently running system software versions
- test the integrity and response time of the network path to an individually targeted network device

Intended audience

The Inter•Poll software and this manual have been designed for use by:

- the administrator of a small to medium-sized AppleTalk network system (7–32 nodes) who wants to plan for growth and adopt sound network management practices at an early stage
- the administrator of a medium-sized AppleTalk network system, possibly at the point of restructuring into an internet, whose network needs call for regular maintenance and diagnostics
- the administrator of a large AppleTalk internet, where diagnostic tools are essential and troubleshooting is a significant part of the job

The technical contents of this manual are written for the reader with knowledge at the level of an experienced user or network administrator. Some of the material is fairly technical, but no new concepts are introduced without explanation.

Inter•Poll and this manual also provide the means for preventive maintenance, to help detect network trouble before users experience problems.

How to use this manual

This manual begins with basic concepts and proceeds to explicit instructions. This means that an experienced network administrator may spend less time on introductory chapters and move quickly to operating instructions. However, it's important for *everyone* using Inter•Poll to become familiar with AppleTalk concepts and terms, such as zones and internets, as these are central to understanding the use of Inter•Poll.

Follow the procedure below to make sure you get the most out of your Inter•Poll program:

- **Step 1:** Read the introduction to Inter•Poll in Chapter 1. Readers new to AppleTalk should take the time to study "AppleTalk Concepts and Terminology," to become familiar with AppleTalk network systems and how their component concepts are interrelated.
- **Step 2:** Follow the installation instructions in Chapter 2, and read "How Inter•Poll Works," the description of program capabilities. Then proceed to step 3 before trying to use Inter•Poll.
- **Step 3:** Create a graphic map of your network layout as described in Chapter 3.
- **Step 4:** Perform some trial network searches to familiarize yourself with Inter•Poll, using the reference information in Part II.
- **Step 5:** Proceed to use Inter•Poll for network maintenance, referring to the troubleshooting guide in Chapter 4 as needed.

System requirements

Inter•Poll and the accompanying Responder workstation identification software require the following hardware and system software:

Hardware

Inter•Poll may be operated on any of the following Macintosh® computers:

- ☐ Macintosh Plus
- ☐ Macintosh SE
- ☐ Macintosh II

Inter•Poll *cannot* be operated on any of the following:

- ☐ Macintosh with 128K of memory
- ☐ Macintosh with 512K of memory
- ☐ Macintosh XL

The Responder software, which is installed on all network workstations, will operate on any Macintosh computer having 512K of memory or more, including the Macintosh 512K and the Macintosh XL. Other workstation types, such as Apple® II and MS/PC-DOS computers, have responder functions built into their AppleTalk network software.

Software

The Macintosh workstation running Inter•Poll must have a System file version of 4.1 or higher. Inter•Poll will display an alert message if the System file does not satisfy this requirement.

Each Macintosh workstation running the Responder software must have a System file version of 3.2 or higher.

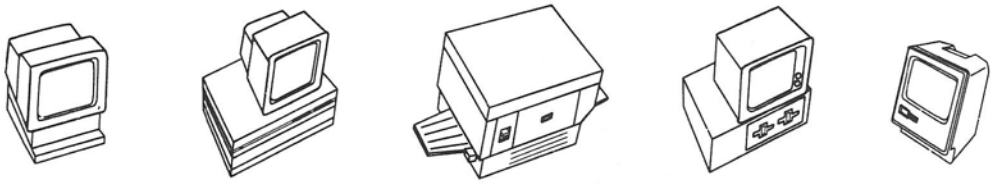
Associated documents

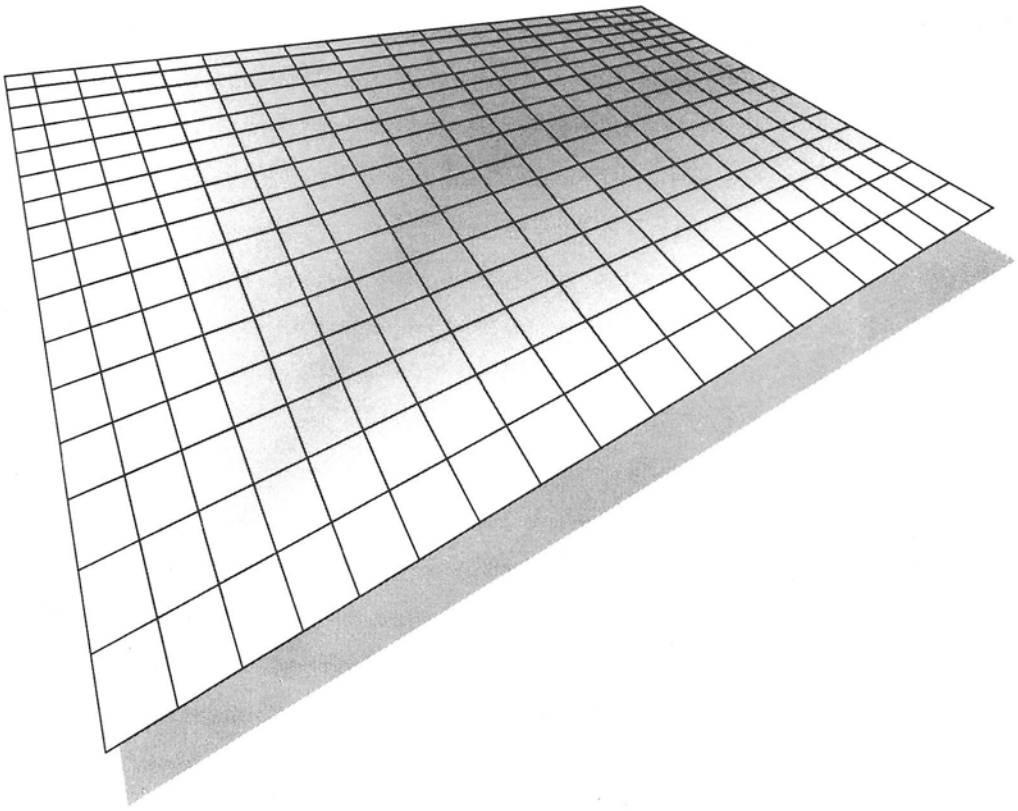
The following manuals available from Apple Computer, Inc. provide additional information about AppleTalk networks:

- *The LocalTalk Cable System Guide* is a brief reference guide to LocalTalk™ cabling, hardware, and installation. Use it to help in the initial setup of your network, and as a basic introduction to LocalTalk networks.
- *Inside AppleTalk* is the technical reference manual that explicitly describes AppleTalk network protocols. This document is available from the Apple Programmer's and Developer's Association (APDA™).
- *EtherTalk User's Guide* provides installation and operation guidelines for those using EtherTalk™ in their AppleTalk network system.

Part I

Operation and Network Troubleshooting





Chapter 1

Introduction to Inter•Poll

Network troubleshooting

Computer networks are transforming the way we work. Instantaneous information sharing—between offices or across continents—has demonstrated the power of individual human efforts joined together by technology. But in any technology the joining of multiple parts can introduce new complexity, and calls for thoughtful planning, monitoring, and maintenance. This maintenance process, *network troubleshooting,* is what Inter•Poll™ is all about.

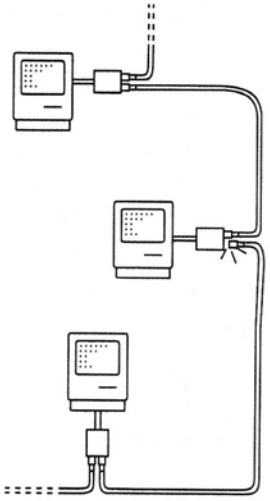
Network troubleshooting involves more than just waiting for users to report problems and then responding. It's essential to develop a plan of how things *should* work, and to make sure they *keep* working according to that plan, before proceeding to the "firefighting" mode of network troubleshooting.

Network administration with Inter•Poll begins with the strategic planning of network layout, continues with regular maintenance to assure network integrity, and ultimately—when problems do occur—involves diagnostic testing and interpretation. Use Inter•Poll:

- to look for devices "missing" from the network, when users report trouble
- to help keep track of the number and location of devices in large internets undergoing frequent changes
- to test network regions where users report poor response or data loss, to help identify the location of breakdown
- to run periodic tests of response at selected network points, to assure continued operating performance

Look for simplicity first

Network users often overestimate the complexity of network problems. The connections and routing functions introduced by the network suggest to them behind-the-scenes activities that can cause problems with hidden sources. Yet the best approach to maintaining a network is to understand its *simplicity.*



Imagine your network as a home plumbing system connecting all the sinks and tubs in a house. The water pipes represent network cable, and water flows through the pipes like data through the network. If the water stopped running at one faucet while all the others continued working, the logical place to check the pipes would be right at that problem sink. If, on the other hand, the hot water throughout the house suddenly became rusty, it would be natural to check the lines at the source: the hot water heater, or the pipe leading from the heater to where it branches toward individual outlets.

When problems arise in a network system, the diagnostic process is similar. *You begin by isolating the location or locations where symptoms can be seen.* Then you follow a list of guidelines that check for the source of the fault in those locations. Inter•Poll is simply a tool that enables you to perform those checks more efficiently, from one central location. The troubleshooting guidelines to use in applying Inter•Poll are detailed in Chapter 4.

Network configuration planning

An efficiently operating network that will serve long-term needs must begin with a well thought-out, flexible configuration plan.

The foundation of your network configuration plan is a network map. The map creation process is addressed in detail in Chapter 3. Specific guidelines to aid in planning your network can be found in this manual's Appendix B, "Network Configuration Guidelines."

The following considerations will determine the network plan:

- user locations and distances between devices
- analysis of user activities (for example, printing, file sharing, and electronic mail)
- departmental groupings/network zones
- location of shared resources (LaserWriter®, AppleShare®, LaserShare™, and so on)
- balanced areas of high and low traffic
- single local network versus multiple linked networks
- network cable medium (such as LocalTalk™ or EtherTalk™)
- directly connected networks versus long-distance telephone links
- cable distribution facilities (conduits, ducts)

Factors including the number of users to be connected, the type of network traffic they will generate, and the physical area to be covered by the network will guide the decision whether to form a single local network or link multiple independent networks together. Likewise, applying the AppleTalk® concept of network zones (described in the next section) will enable the logical definition of groups of users who will share network services, such as AppleShare file servers and LaserWriter printers.

Another key consideration will be which type of cable medium to use, whether LocalTalk or EtherTalk, for example.

The concepts described in the next section will give you a better understanding of how an AppleTalk network system operates, to help in your administration and troubleshooting efforts.

AppleTalk concepts and terminology

An AppleTalk network system uses standardized communication **protocols,** or systematized rules of data transmission. These protocols manage the way data traveling on the network is addressed, sent, received, and read by network devices.

The AppleTalk terminology defined below will be used frequently throughout the Inter•Poll documentation. The AppleTalk protocols themselves are described in Appendix A.

Cabling systems and speed

AppleTalk is a network system capable of operating over several types of cabling systems at a wide range of speeds. While all AppleTalk networks use the same AppleTalk protocols, they do not all use the same cables and connections.

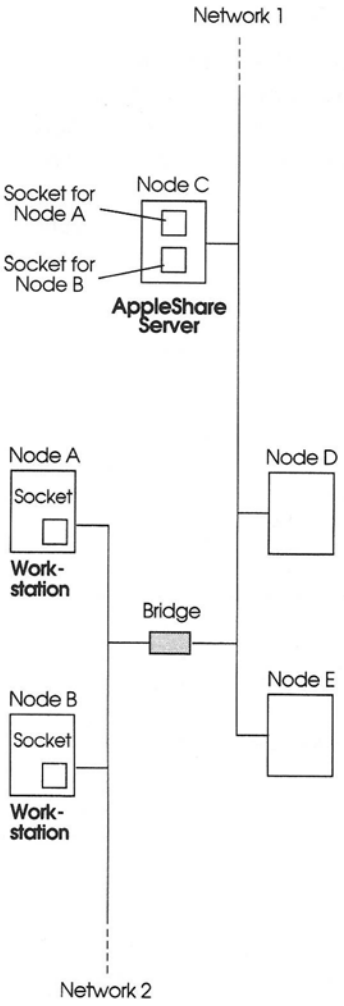
The design of AppleTalk allows customers to select the cabling systems that best suit the needs of their installation, while retaining the same AppleTalk services and interface. For moderate traffic requirements, **LocalTalk** is a low-cost cabling system with medium throughput that connects to the printer port of any Macintosh computer. **EtherTalk** uses the higher-performance cables of an Ethernet network and connects to special interface cards in certain Macintosh computers.

Using bridge devices, network segments of different cabling types can be connected together as needed.

Packets

Data is transferred in AppleTalk network systems in prescribed formatted units called **packets.** Packet formatting appends control information to the data, such as the addresses of the sender and destination.

AppleTalk addressing



Nodes and node ID

A **node** is a single addressable entity connected to an AppleTalk network. A node on an AppleTalk network may be a workstation, such as a Macintosh® II, or a network server, such as a file server.

Each node has an associated identification number, called the **node ID.** This is the address used by AppleTalk protocols in delivering data to the node. ID assignment is performed dynamically by the AppleTalk software at the time of device startup; no permanent ID is fixed to any device. In this way, nodes may be moved between networks without the risk of producing ID conflicts.

Sockets

Sockets are individual addresses within network nodes. Sockets make network addressing more explicit than node IDs, allowing multiple addresses to be specified within a given device.

In this way, two or more network servers, such as a LaserWriter spooler and an AppleShare file server, can coexist in the same Macintosh node without any network addressing conflicts.

Named and unnamed devices

A **named device** is any device that is registered on the AppleTalk network by a user-defined name. Registration of a Macintosh workstation is performed by the Responder™ software, which identifies the device during Inter•Poll searches. Responder uses the name entered in the Macintosh Chooser as the name of the workstation.

Network servers such as a LaserWriter or AppleShare server automatically register their names and therefore do not need to run the Responder.

An **unnamed device** is any device connected to the AppleTalk network that has not registered a name (for example, workstations running non-Apple network software). These devices can generally be detected by Inter•Poll, but not identified by device type or name.

Internets

AppleTalk supports the interconnection of multiple AppleTalk networks of any cabling type into an **internet.** A **network number** is assigned to each connected network on the internet for addressing purposes. A socket's **AppleTalk internet address** consists of a socket number, the node ID of the node in which the socket is located, and the network number of the network to which the node is connected.

Zones

A **zone** is an arbitrarily defined grouping of AppleTalk networks that may be used to identify a subset of the total internet. Zones facilitate the departmental grouping of users, and the sharing of services such as LaserWriters across the internet. The usefulness of zones is illustrated by the Macintosh Chooser, which presents to the user only those printers and shared services available in the zone selected by the user.

There is no size limit to a zone; it can be defined to contain one network, several, or the entire internet. However, zones may not overlap to share any networks (and thus nodes) in common.

AppleTalk bridges

The linking of an AppleTalk network to one or more additional networks is accomplished with the use of a **bridge.** A bridge device has multiple communication ports, and is capable of routing data to other bridges and devices on the internet.

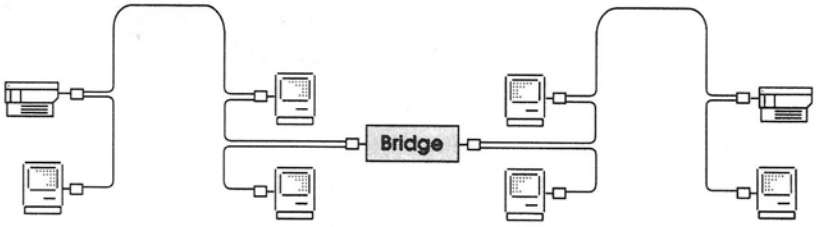
Bridges are also known as internet routers. They perform a routing function by forwarding a data packet from its sending node through a chain of bridges until it reaches the AppleTalk network on which its destination node is located.

Bridge-resident logic includes protocols that perform the packet routing, maintain network routing information, and perform other functions detailed in AppleTalk protocol documentation (see *Inside AppleTalk*).

The following bridge configurations are supported:

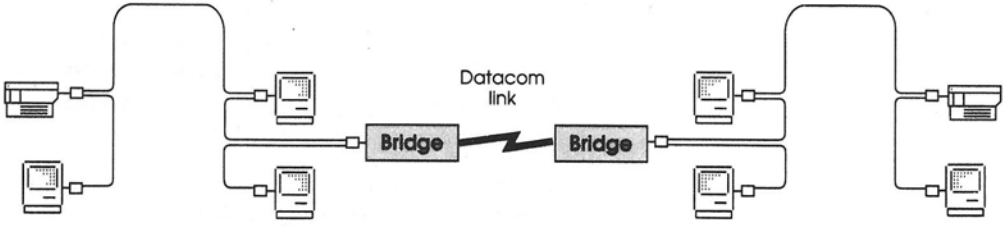
Local bridge

A **local bridge** is used for the direct interconnection of two or more networks in close proximity.



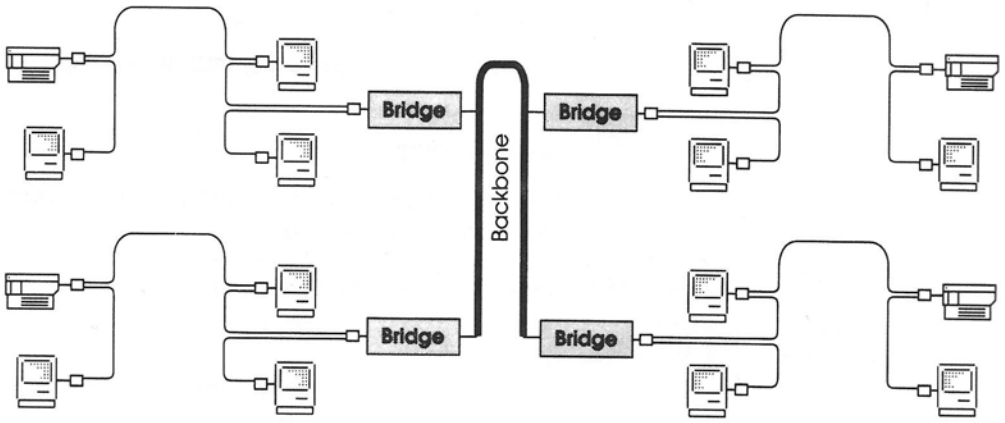
Remote bridge

Where remote networks are interconnected via long-distance links (such as modems and telephone lines), each network is connected to an AppleTalk bridge, which in turn is connected to the datacom link. This configuration is called a **remote bridge.**



Backbone bridge

A backbone network topology supports multiple bridges sharing a central backbone network, allowing networks to be linked in a nonserial manner. This minimizes the path between any two points on the internet and thereby improves performance.



Gateways

A **gateway** is a device that connects an AppleTalk protocol-based network system to a non-AppleTalk protocol system. The gateway serves as a translator between the protocols of the two connected networks. Inter•Poll searches do not extend across gateways into foreign protocol networks.

Hops

A **hop,** signifying "one bridge away," is a unit count between networks on the internet. For example, a network device located on a network separated from yours by three bridges (in the shortest route) would be three hops away.

AppleTalk protocols support a maximum of fifteen hops in the path from a packet's sender to its destination node.

Chapter 1

Introduction to Inter•Poll

Network troubleshooting

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Chapter 2

Getting Started

This chapter describes the installation and operation of the Inter•Poll program. Follow the installation procedure and read the rest of the chapter to familiarize yourself with Inter•Poll. Then go on to Chapter 3 and follow the directions to produce your network map before proceeding to use Inter•Poll.

Select a network administrator

Installing and operating Inter•Poll will require the selection of a network administrator who is responsible for maintaining the network. The general responsibilities of the network administrator will include some or all of the following:

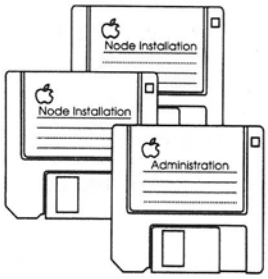
- participate in planning the network system layout, including the design of network and zone boundaries in internets
- assign and configure network numbers and zone names in bridge devices
- coordinate the addition, removal, and relocation of devices on the network
- develop and maintain a current map of the network layout and device locations
- coordinate the selection and implementation of network resources, such as file servers and electronic mail facilities
- perform regular preventive maintenance to help assure continuous network operation
- maintain control of system software version compatibility among network devices
- troubleshoot network problem reports, locate malfunctions, and perform repairs

If a network administrator is not already designated for your network, it's recommended that you choose one at this time. Inter•Poll should be installed on the administrator's workstation and generally operated from that location (although network problems affecting this workstation may at times require Inter•Poll to be run from another location).

❖ *Note:* Refer to "System Requirements" in the Preface of this manual for information on the hardware and software environments that will support Inter•Poll.

The network administrator must be familiar with Macintosh operation, and will benefit from prior training in hardware, software, or data communication, but is not required to have any specific technical background. Once assigned, the position should remain with one individual if possible. Network problems are best solved by someone with continuous access to the network's configuration, status, performance history, and so on. (It's recommended, however, that you train an alternate who can be responsible for the network when the administrator is unavailable.)

Install Inter•Poll



The Inter•Poll program and supporting software are provided on three startup disks, each containing the following files:

- ***Administration*** **disk (800K):**
  - ☐ the Inter•Poll program file
  - ☐ the MacDraw Network Map file
  - ☐ a System Folder
- ***Node Installation*** **disk (800K version):**
  - ☐ the Responder node identification software
  - ☐ the Installer program
  - ☐ a System Folder
- ***Node Installation*** **disk (400K version):**
  - ☐ the Responder node identification software
  - ☐ the Installer program
  - ☐ a System Folder

Follow the instructions below to install Inter•Poll on your network.

Step 1: Install the Inter•Poll program

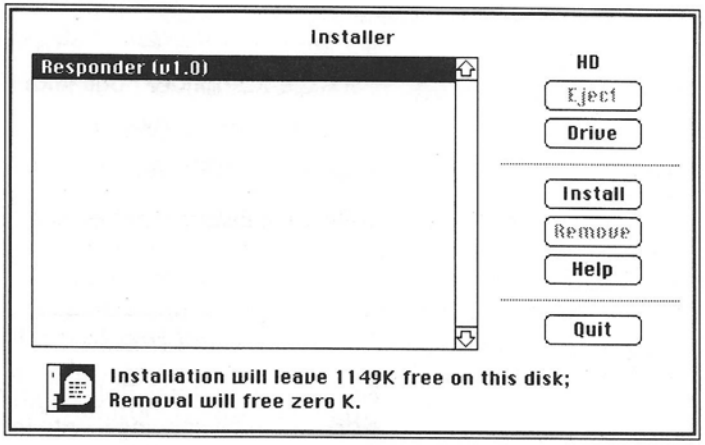
First, install the Inter•Poll program on the network administrator's workstation by copying it onto the system's startup disk. You may place the program file in any convenient folder, or keep the Inter•Poll icon directly accessible on the Macintosh desktop.

Step 2: Install the Responder software

Next, the Responder node identification software must be installed on the administrator's workstation *and all other Macintosh nodes on the network.* This software enables Inter•Poll to recognize the device and acquire various identifying data when searching the network. Responder will register the User Name currently in the Chooser desk accessory as the Macintosh workstation's AppleTalk device name.

Follow the instructions below to install Responder on each Macintosh workstation. (A 400K version of the *Node Installation* disk is provided to allow you to install Responder on older Macintosh workstations requiring this format.)

- ☐ Insert the appropriate *Node Installation* disk and open the Installer file.
- ☐ When the Installer dialog box appears, select the workstation's startup disk as the disk on which to install Responder.
- ☐ Select Responder as the resource you want to install and click the Install button.
- ☐ Once the installation procedure is complete, quit the Installer and eject the Inter•Poll *Node Installation* disk.
- ☐ Restart the system.



The Responder software will be installed in the workstation's System Folder. If no name is currently registered in the workstation's Chooser desk accessory, a dialog box will appear during the installation procedure and request that a name be entered for device identification.

LaserWriters, file servers, and other network services visible in the Macintosh Chooser are named devices, and do not require the Responder software for identification.

Important Since Responder registers the User Name entered in the Macintosh Chooser as the device name, it is strongly advised that users be instructed not to change the User Name arbitrarily. This way names will remain consistent on device lists, and correspond to network maps.

Step 3: Copy the Network Map file

A graphic tools file named Network Map is provided with Inter•Poll. This file contains symbols that can be used to construct a network map with the MacDraw application. Copy this file into any convenient folder, and refer to Chapter 3, "Network Mapping," for instructions on creating the map.

Inter•Poll and network devices

Inter•Poll finds named devices on the internet using the services of AppleTalk's Name Binding Protocol, or NBP (defined in Appendix A and described in detail in *Inside AppleTalk*). To be visible to NBP, a device can be named in one of three ways:

- Macintosh workstations are named by the Responder software, using the name entered in the Chooser.
- LaserWriters, AppleShare servers, and other devices visible via the Macintosh Chooser give themselves names using NBP.
- Other network devices may have name registration capabilities, as defined in the user manual of the particular device.

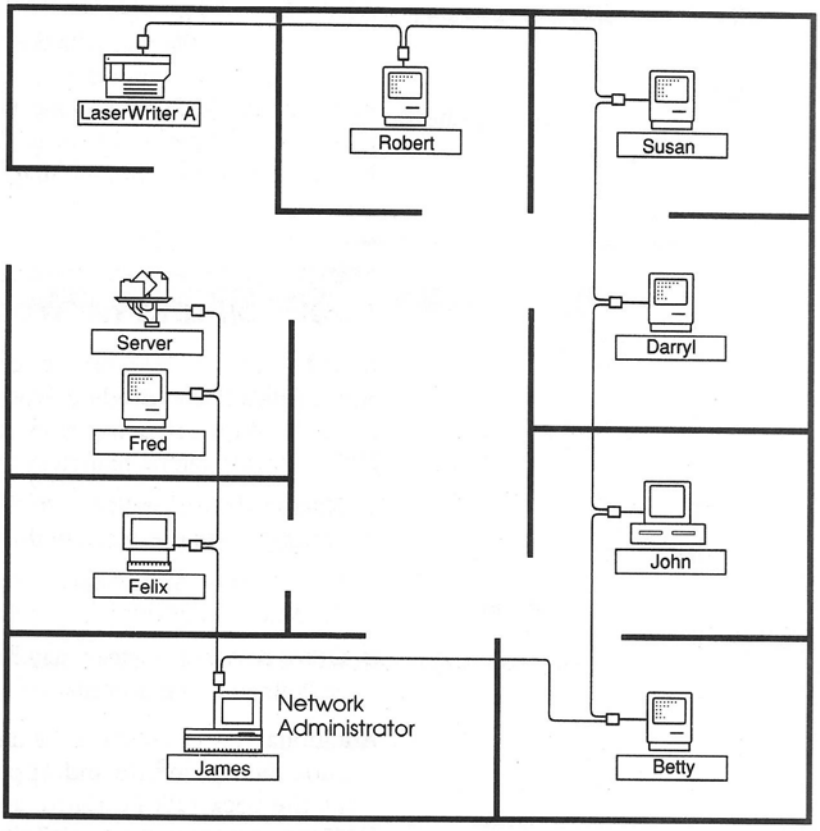
Additional devices that can be named by one of the above methods include the Apple® IIe and Apple IIGS®, MS/PC-DOS computers (with the LocalTalk PC Card), and Digital Equipment Corporation VAX systems (running AppleTalk for VMS software).

Inter•Poll can also detect unnamed devices on the network, although no specific information is reported about these devices. Unnamed device searches can be used to check the connection status of unnamed network devices.

First look: An Inter•Poll example

What follows is a brief example of Inter•Poll at work. The network problem chosen to illustrate the program's capabilities is simple and quite common: a network break caused by a disconnected cable.

The following diagram is the network map for our sample network. This map should show the network layout and—if the network size permits this level of detail—indicate the location and name of each connected device.



A network problem report

In our example, network user Betty comes to you, the network administrator, to report a problem. She can no longer see the network's LaserWriter in her Macintosh Chooser window, and consequently cannot select it to print her documents.

At this point you could proceed in one of two ways:

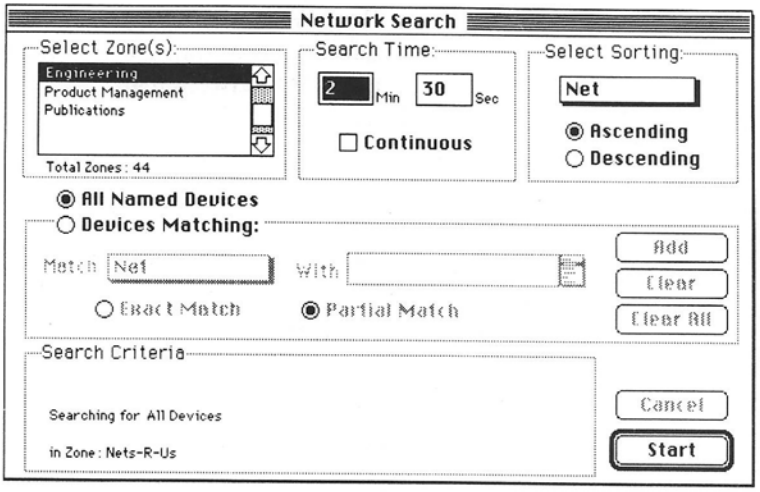
- turn to Inter•Poll for a listing of all active devices on the network
- begin with spot-checks at Betty's workstation and at the LaserWriter

Without Inter•Poll, the process could also involve visual checks at each connection point between the two devices.

Let's turn directly to Inter•Poll.

Start Inter•Poll and begin a search

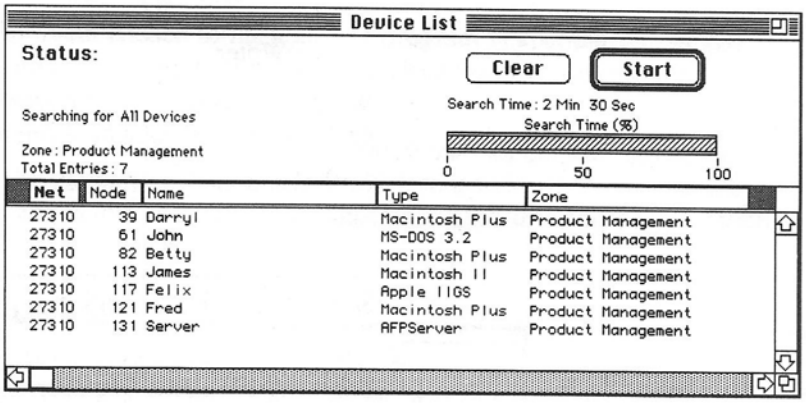
On startup, Inter•Poll displays the Network Search window, shown below, which allows you to specify different types of device lookups. For a standard search of your entire network, you would simply accept the program's default settings by pressing Return or clicking the Start button to begin the device search.



The device list

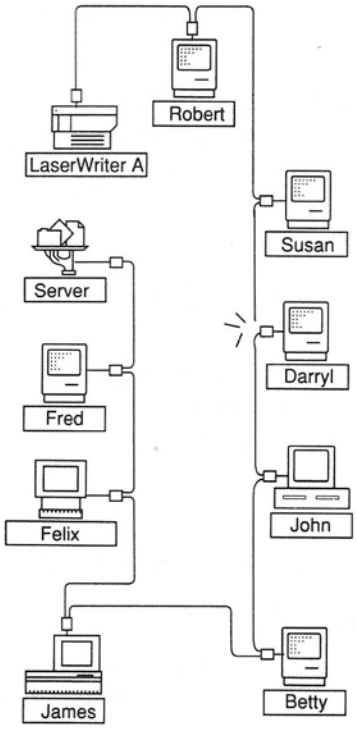
The network search causes the Inter•Poll device list to be displayed. This list includes only *active* devices—those that are connected and turned on—and, unless otherwise specified at the time the search is performed, lists only devices identified by an AppleTalk name.

In our example, the device list would look like this:



If your network were so small that you knew the name and location of each device by heart, this listing alone—without the network map—could reveal which devices were missing.

However, in most cases, you would want to compare the list with a reference showing how your network *should* look with all devices in place: the network map.



The network map

Now, refer back to the network map. This map shows our sample network with all nodes and devices in place.

Compare the map with the device list to determine which devices, if any, are missing from the list.

It's evident now that more than just the LaserWriter is being affected. Two other workstations, Robert's and Susan's, are also missing from the list, in addition to the LaserWriter. Betty's workstation, however, is listed as active on the network.

Locating the break

What does this information tell you about the source of the network problem? Most likely, if the break were located at the LaserWriter, Robert's and Susan's workstations would have no reason to disappear from the device list.

Rather, the logical place to look for the break would be the network segment connecting the first *missing* device, Susan's, with the first *listed* device next to it, Darryl's.

At this point, you would go to the actual location and follow the local troubleshooting guidelines provided in this manual. These would include checking cables, connectors, software, and hardware at this segment of the network.

More examples

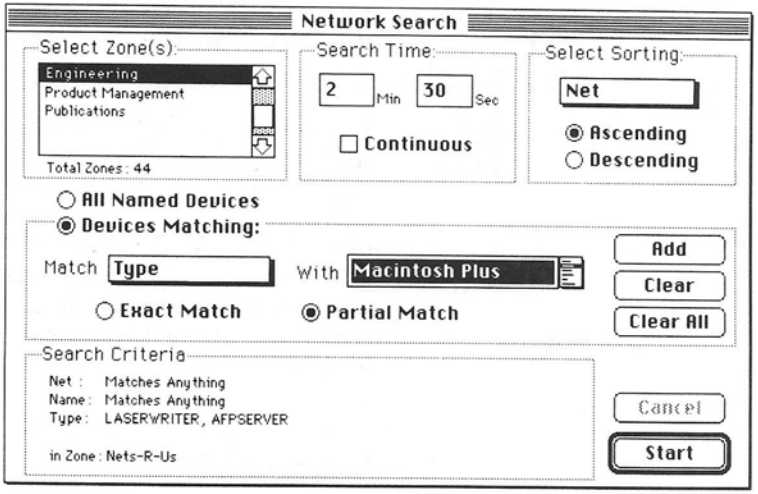
The above example—a network search to diagnose a simple break—is just one of many ways to use Inter•Poll. The program's capabilities are described in the overview that follows, and Chapter 4, "Network Maintenance and Troubleshooting," provides many practical examples of Inter•Poll network administration.

How Inter•Poll works

Inter•Poll's program functions are described in the following sections. Specific instructions for program operation and for using each program option are provided in Part II, "Inter•Poll Reference."

Enter search criteria

On program startup, the Network Search window is displayed, allowing you to enter **search criteria.** These criteria direct the program to look for nodes that satisfy the parameters of your search.

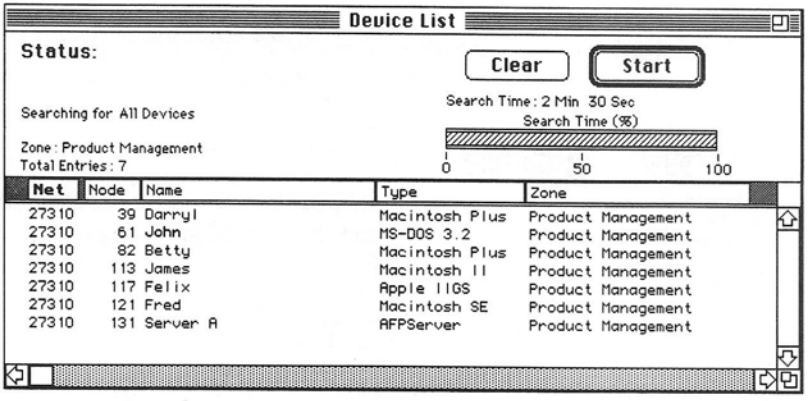


The following search criteria may be specified:

- network zone(s) in which to search
- search duration in minutes and seconds, or continuous searching
- sort key (by network number, by device name, and so forth) and sort order (ascending or descending) for the device list
- listing of either all named devices or devices matching given parameters:
  - network number match
  - device name match
  - device type match
  - listing to include unnamed devices

Display the device list

Once search criteria have been entered, the network search is initiated, and Inter•Poll displays the Device List window.


Device List
Status:
Clear
Start
Searching for All Devices
Search Time: 2 Min 30 Sec
Search Time (%)
Zone: Product Management
Total Entries: 7
0
50
100
Net Node Name Type Zone
27310 39 Darryl Macintosh Plus Product Management
27310 61 John MS-DOS 3.2 Product Management
27310 82 Betty Macintosh Plus Product Management
27310 113 James Macintosh II Product Management
27310 117 Felix Apple IIGS Product Management
27310 121 Fred Macintosh SE Product Management
27310 131 Server A AFPServer Product Management

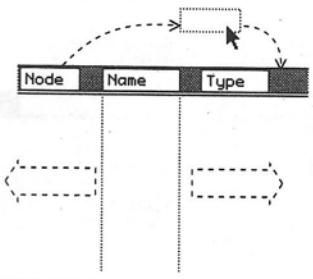
As Inter•Poll scans the network for devices meeting the search criteria, the results of the search are listed under the following column headings:

- **Net:** the number of the network on which the device is connected
- **Node:** the device's node ID
- **Socket:** the socket number, or address, that is responding within the node (this column can be selected for display, but is not selected in the default listings)
- **Name:** the device name registered by Responder or by the network application
- **Type:** the device type (for example, the type "AFPServer" for an AppleShare file server)
- **Zone:** the name of the AppleTalk zone to which the device belongs

Format custom displays

In the Device List window, the bar containing the display column headings is an interactive formatting tool. Its functions are

- to move columns horizontally into any order
- to remove any column from the display
- to make any column wider or narrower to the limit of the available space



By positioning the pointer in a heading label (such as "Node"), you can drag the label to any other position in the heading bar, or drag it off the page completely to remove the column from the display.

Column width can be changed by dragging the label's edge to the desired width.

Get system information

One common type of network trouble stems from connected devices running conflicting versions of system software, specifically the Macintosh System file, Finder, or LaserWriter driver. User-reported symptoms in such cases include an inability to use network services, and possibly additional network malfunctions.

The network administrator can use Inter•Poll's System Information window to display the names of all active Macintosh workstations, together with a listing of the system software version each one is running. In this way any nonconforming workstation can be identified and its system software updated.

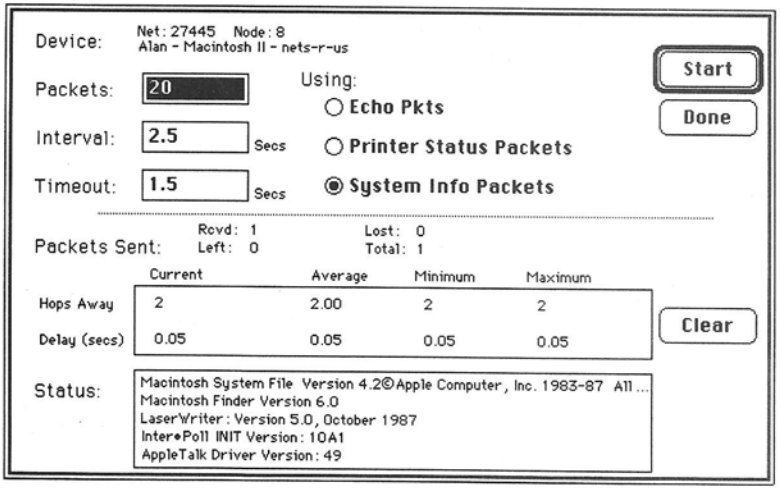
Print or save device list

In addition to displaying search results on the screen for immediate use, Inter•Poll allows you to save the currently displayed device list as a stored file, or send it to a printer.

It's useful to maintain a printed list of networks and devices for reference. This list should be updated and reprinted as changes are made to the network.

Test individual devices

Any device on the network can be selected from the Device List window and targeted for individual testing using **loopback tests.** This is a troubleshooting tool that aids in localizing network faults by enabling test packets to be sent to a device, returned, and timed, checking for successful transmission.



The following test packet types are provided:

- **Echo packets** test link integrity between the Inter•Poll workstation and any active named device.
- **Printer packets** test LaserWriter and ImageWriter® printers, and return printer status information (printers do not respond to echo or system information packets).
- **System information packets** query nodes running the Responder for a report of their system software versions.

❖ *Note:* All three types of packets can be sent to any device, even if the particular device is unnamed, and therefore of unknown type (in this way the device type may sometimes be determined).

For details on the use of loopback tests, refer to the description of the Device Test window in Part II of this manual.

Chapter 3

Network Mapping

A graphic map of your AppleTalk network system is a basic and necessary planning tool. It will help you design the initial network layout, and keep track of changes and additions to the network in an orderly way.

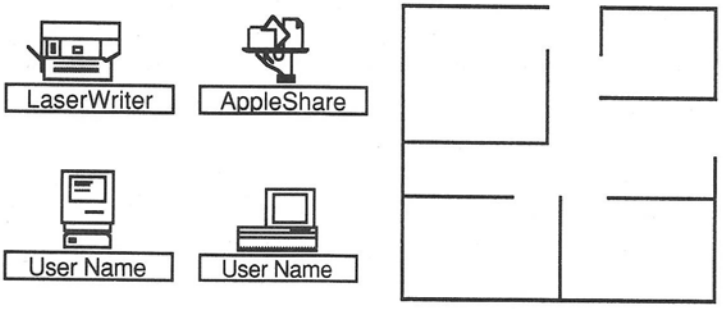
The network map is also an essential part of your troubleshooting arsenal. For example, if Inter•Poll were to show that a given bridge or group of nodes were not responding, an examination of a map of the internet might reveal the obvious point where these might be cut off from the rest of the network.

The importance of network maps becomes most evident as networks grow into internets and are complicated by bridges, gateways, backbone networks, and often multiple office floors or buildings.

Network map components

The Network Map file provided on your Inter•Poll *Administration* disk contains symbols that can help you construct a network map. These include icons that represent devices (such as Macintosh workstations and LaserWriters) and architectural components that you can incorporate into an office floor plan.

The MacDraw program or a compatible graphics application is required to open and work with the network map components. However, if a graphics program is not available to you, the guidelines in this section are equally applicable to a map created by any other method, whether manual or computer-assisted. What's essential is to create a visual reference that you can correlate with Inter•Poll's device lists.



Creating the network map

Follow the procedure below to produce the network map. If you don't have access to MacDraw or a compatible program, the principles of network mapping can be applied to whatever process you are using.

Be sure to refer to the examples of typical network maps provided at the end of this chapter.

Step 1: Acquire a floor plan

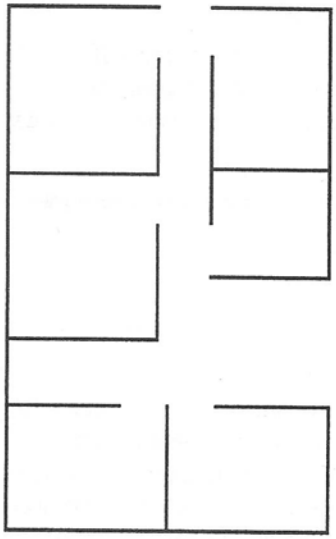
It's often possible to avoid the time-consuming chore of measuring and drawing an original floor plan. The facilities management department of your company, or the building management office of your building, should have floor plans available of the type used for electrical and telephone wiring, emergency evacuation, or similar purposes.

You will find a model floor plan to be helpful and time-saving in creating your map.

Step 2: Reproduce the plan in MacDraw

You'll want to recreate the floor plan with your Macintosh now, so that you can draw the network and nodes in position.

- *Note:* If you simply draw your network manually onto a preexisting floor plan (to avoid the task of reproducing the plan in MacDraw), then each future change in the layout will require you to erase and redraw the affected network segments. Unless your network is very small and simple, this may be difficult and time-consuming.



Open the Network Map file

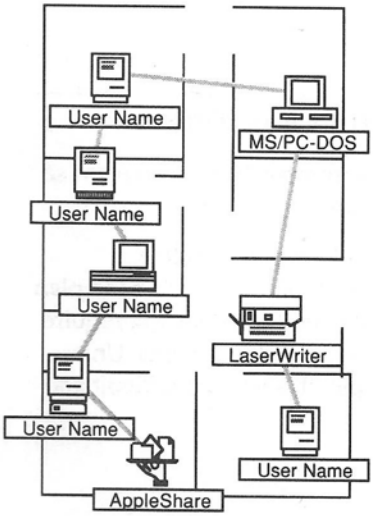
Open the Network Map file to access the predrawn network components. Before beginning your own map, use the Save As command from the File menu to rename the open copy of the Network Map file with your own map's name. In this way you can save your drawing, and you'll keep the network mapping tools for future use as well.

Office parts

The Network Map MacDraw file contains several types of standard floor plan components, such as office wall segments. These can be copied and reproportioned as needed for your plan.

Work in full-size screen display mode, and reduce your drawing later if you need a very large area. Consult your MacDraw user's manual if you need help with this application.

Step 3: Add the network cable and nodes



The Network Map file contains symbols that represent the various types of nodes on AppleTalk networks. In addition, you may use MacDraw's drawing features to create your own symbols.

Position node symbols

Once your floor plan is completed, select the node symbols that are appropriate for your network.

You can enlarge, reduce, and duplicate these symbols as many times as necessary to position them where the nodes are located in your floor plan.

Label node names

Each MacDraw node symbol has a node name label below it. Fill in the label with the name that is to be registered for this node on the AppleTalk network. (Remember that a single device can have more than one name if multiple network services are running on it.)

Draw the network cable

The Network Map file doesn't provide any predrawn cable symbols, because these are best created with MacDraw's standard line drawing features.

Select a line width that's bold enough to stand out in your floor plan—at least medium weight. MacDraw's segmented-line drawing feature, called the "polygon tool," will allow you to draw, change direction, and continue a single cable from node to node and from room to room.

❖ *Note:* Use the Pen pull-down menu of line drawing patterns to select a different pattern for each network in an internet, or to set off a backbone from other cables. In this way your floor plan will show the different network segment locations at a glance.

Step 4: Print the map

Use a LaserWriter or ImageWriter to create printed copies of your network map. Take advantage of the legal-size paper capability of the printer, and the Landscape printing option for wide maps.

If your network is large and complex, it may be impractical to reduce the drawing to print on a single sheet of paper. Instead, it can be printed in separate segments and taped into a single map.

Maintaining the network map

Most computer networks are dynamic systems: they frequently change in size and configuration to respond to user needs.

Whenever such changes occur, they must be recorded on the network map, to avoid errors in correlating Inter•Poll's device list output with the map. Always keep a *current* printed map for use in Inter•Poll troubleshooting.

Examples of network maps

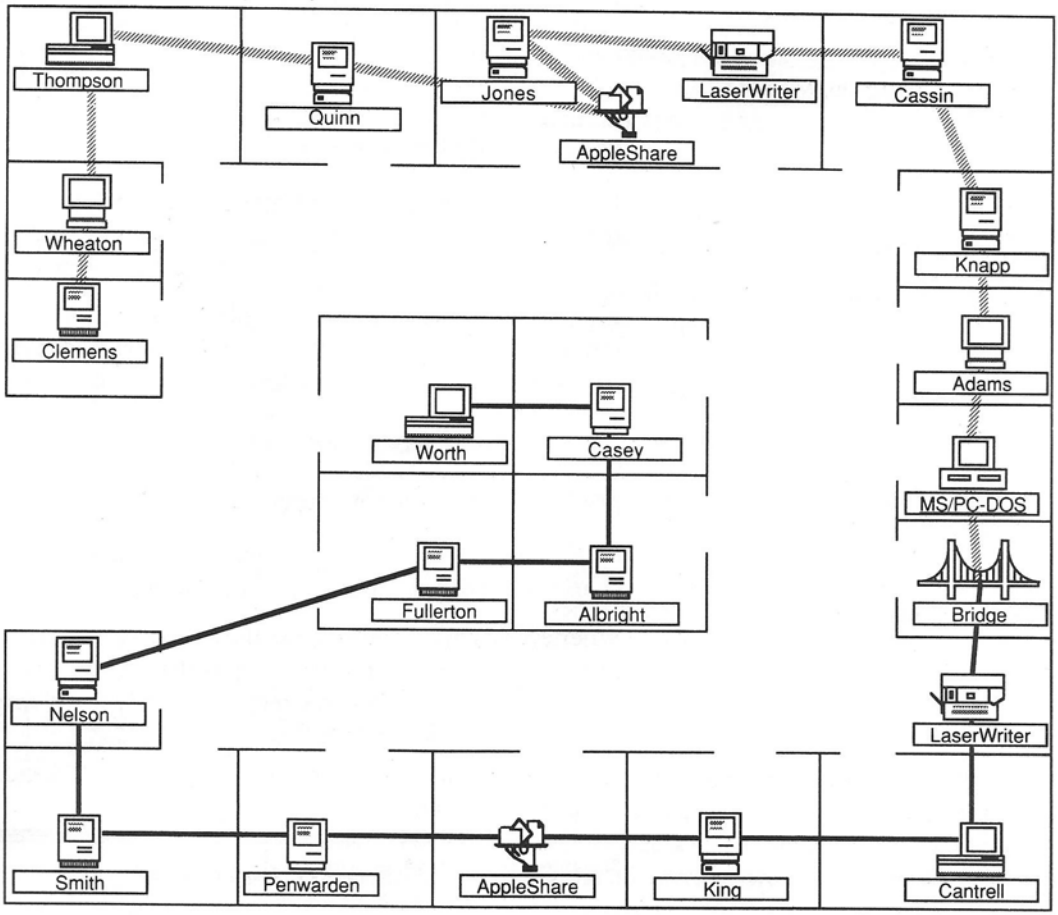
Examples of the two most common types of network maps are shown on the following pages. Use them for reference, but feel free to construct your own map in whatever format is most suitable to your network situation.

Node and floor plan layout

The most useful type of network map will show

- the floor plan
- the network cabling
- the location of each network device

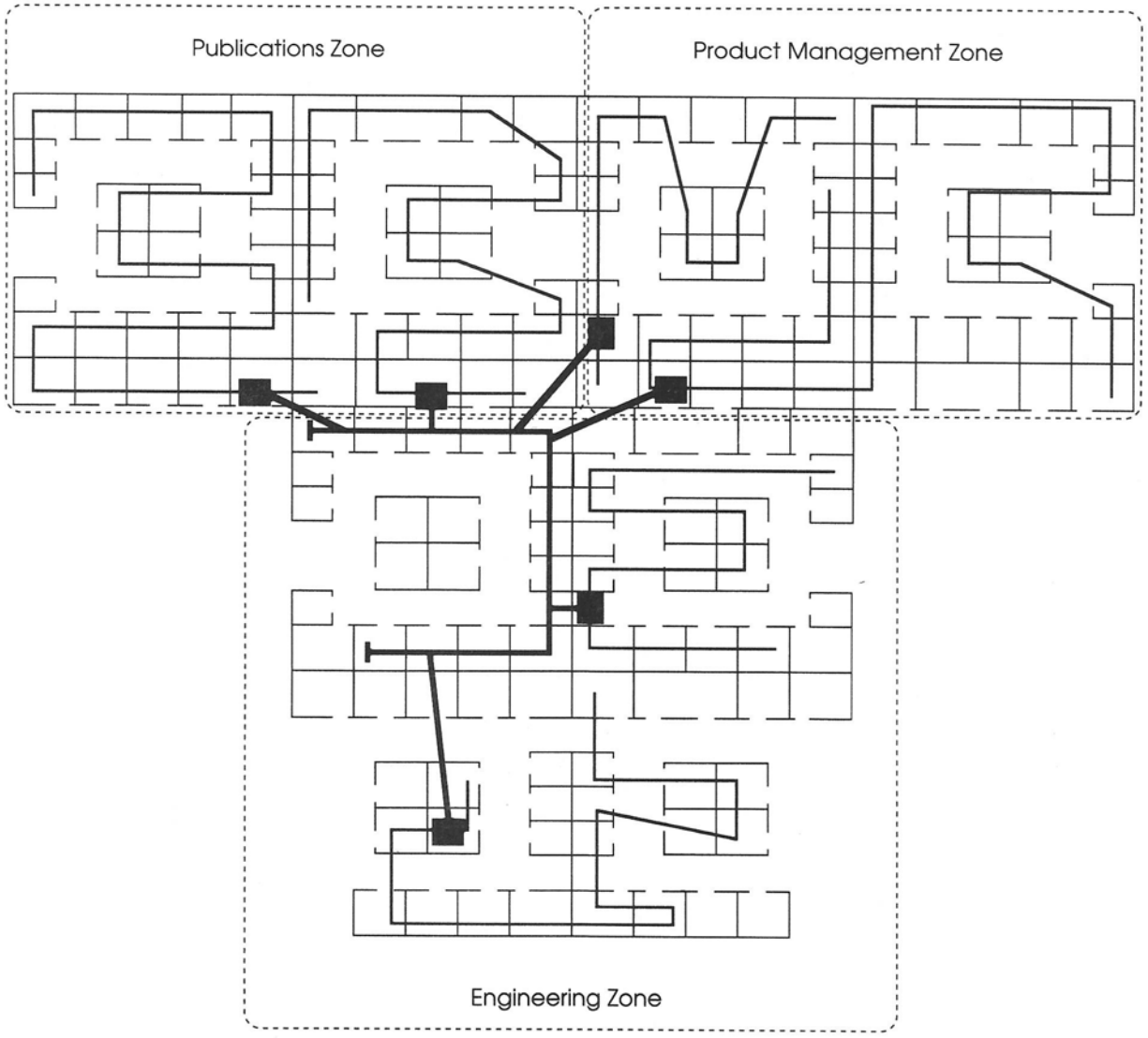
Each workstation and network service on this map should be labeled with the device name. (For very large networks, this level of detail may be impractical; see the next section, "Skeleton Network Layout.")



Skeleton network layout

Large network systems with hundreds or thousands of nodes are better depicted with a more general map of network locations. This "skeleton" view of the internet layout allows visualization of the relative placement and interconnection of individual networks.

❖ *Note:* The skeleton layout map should ideally be created in addition to the "node and floor plan" maps. These can be produced separately in single-network segments for reference to individual device locations.



Chapter 4

Network Maintenance and Troubleshooting

This chapter consists of three sections:

- "Basic Guidelines" describes techniques used at every level of Inter•Poll troubleshooting. These guidelines deal with hardware, software, and cabling problems on LocalTalk networks, and can be applied to EtherTalk and other networks as well.
- "Network Maintenance with Inter•Poll" provides an overview of preventive maintenance techniques, using progressive checks of network integrity to be performed on a regular basis.
- "Network Troubleshooting with Inter•Poll" describes the conceptual strategy with which to approach network troubleshooting, through a series of symptom-and-procedure troubleshooting scenarios.

❖ *Note:* Not all information in this chapter is applicable to all internet types or sizes. Administrators of smaller internets and single networks may wish to skip sections pertaining to zones and backbone networks, for example. Use the guidelines that pertain to the needs of your own network system.

Basic guidelines

Before proceeding to examples of network problems and strategies for dealing with them, here are some basic guidelines that apply to all network troubleshooting.

Recognize network-based problems

As noted at the beginning of this guide, an AppleTalk network is only a pipeline that serves to transport data among connected devices. The physical network components are simple, and follow straightforward rules of operation.

Yet it's often easy for users to blame any unspecified malfunction on "the network." When this happens, it's up to the network administrator to determine whether the fault is in fact network-related. To do this, start by analyzing the symptoms:

- **Are the symptoms related to a single workstation?**

  If so, begin with the assumption that the problem is local, and try to solve it at this level before proceeding to network troubleshooting.

- **Could the cause be user error?**

  Did the user try to access a network service without first selecting it in the Chooser? Or select a print spooler in place of a printer? Retrace the steps that led to the problem and try again if appropriate.

- **Could the cause be non-network software or hardware?**

  At times a system fault can occur while someone is trying to use the network, although the cause may not be network-related. Are the software and hardware involved at the problem location known to be problem-free? Follow the basic steps of local troubleshooting described in the next sections.

First aid: Software

A frequent source of trouble among networked devices is software incompatibility. The following are common varieties of this problem that can be checked at the local node level.

System software version inconsistency

Any node can cause network problems if it is operating with system software that differs from the network standard (for example, an outdated version of the System file). Symptoms might be limited to the offending node, or might affect network performance in other ways.

Local device check: Software versions can often be checked at the affected workstations with the About [Program Name] command from the Apple (🍎) menu, or the Get Info command from the File menu.

Remote device check: Inter•Poll can also check system software versions on individual remote nodes that are running the Responder software. To do this, use the System Info Packets feature of the Device Test window, described in Part II, "Inter•Poll Reference." This test reports the currently running versions of the System, Finder, and LaserWriter software from any targeted device on the internet.

Remote network-wide check: A listing of system software versions can be displayed for a network-, zone-, or system-wide selection of Macintosh workstations, using the Get System Info command from the Special menu, described in Part II, "Inter•Poll Reference."

Check with your authorized Apple dealer for the latest versions of system software for the devices on your network.

Driver incompatibility

Most network servers, including LaserWriters, file servers, and electronic mail applications, have associated controller programs called **drivers** that must be installed on every workstation using the service. When a network service fails to respond, the cause may be an incompatible software driver at the workstation requesting service.

LaserWriters are particularly sensitive to the version numbers of Macintosh LaserWriter drivers. Use Inter•Poll to make sure that all workstations are running the same versions of these files.

Usually, but not always (depending on the service type), an error message will be presented at the requesting workstation indicating an incompatible driver version. It will be necessary to remove this driver, install the appropriate version, and restart the system before service to this workstation can be resumed. This can be done by using the appropriate installation program (see the instructions provided with the corresponding software).

Printing errors

Errors can occur during the internal file formatting that precedes LaserWriter printing, resulting in the failure of the LaserWriter to respond. For example, the text formatting software may encounter a printing command that cannot be executed with the current font capabilities, causing a system error. This problem may not be described by any on-screen error message, causing the transmission failure to appear network-related.

When you suspect such an error in the formatting process, verify that the necessary printer software is present, and check response by printing a different file from the same workstation. Text formatting errors that disrupt printer service can often be cleared by resetting the printer.

First aid: Hardware

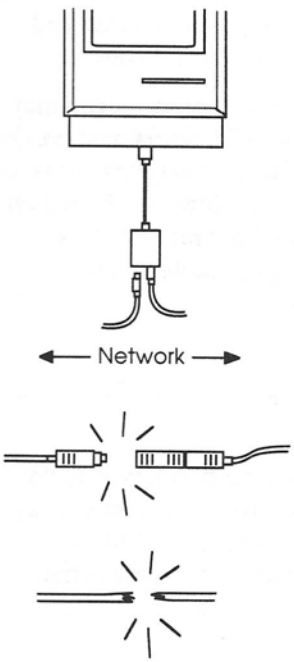
This section describes the most common hardware-based causes of network failure. Consider these factors first when users report problems.

❖ *Note:* The hardware and cabling descriptions apply to LocalTalk networks, but EtherTalk and other networks follow similar principles of operation.

Breaks in network connections

When a break occurs on the network, nodes on opposite sides of the break can no longer "see," or communicate with, anything on the network beyond the point of the break.

In addition, network performance may become erratic even among nodes situated on the same side of the break, due to the possibility that a network cable is now improperly terminated (see the following section, "Cable Termination").



Here are three principal types of network breaks to look for:

Break at connector box: If this occurs, the affected node becomes the network termination node for the side of the network that remains connected. Devices on this side may continue to operate properly, but will have no contact with devices beyond the termination point.

The disconnected side is now improperly terminated, and is likely to experience performance problems in addition to the break in communication.

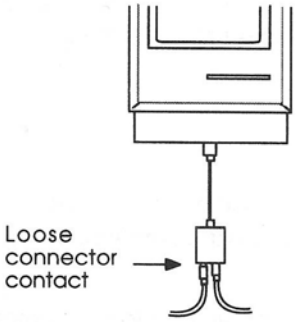
Disconnected cable extenders: Cable extension connectors can become unplugged when moved around. If this happens, each side of the break will become an improperly terminated network, and will experience associated performance problems.

Severed cable: Most network cable is sturdy, but breakage can still be caused by extreme stress, such as moving heavy furniture over cables. A severed cable will produce the same symptoms as unplugged cable connectors.

Intermittent connections

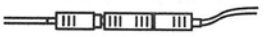
When a network connection becomes loose or damaged without breaking completely, communication becomes intermittent between nodes on opposite sides of the problem site.

Here are three principal causes of intermittent connections to look for:



Loose connector contact: LocalTalk connector boxes are often moved, and attached nonlocking cable connectors can easily become loosened. These connectors should be checked and tightened whenever devices are moved.

When properly installed, LocalTalk connectors lock into place. Older AppleTalk Personal Network connectors do not lock, and require third-party retention devices to help secure cable connections.



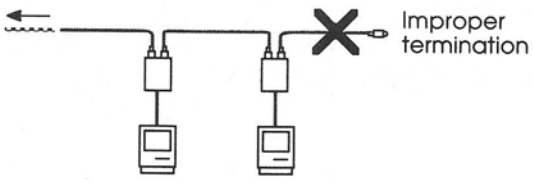
Loose cable extenders

Loose cable extenders: Nonlocking connector cables can become loose, although no break in contact may be visible. When checking for intermittent connections, completely unplug and reconnect the cables to make sure that firm contact exists.

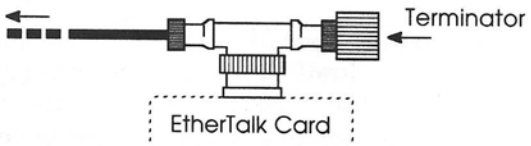
Damaged cable: A LocalTalk cable that has been damaged may still be capable of intermittent throughput, with occasional breaks in transmission. This may be the most difficult of network faults to detect if no external cable damage is visible. However, Inter•Poll may help to isolate the location of a throughput problem to a particular part of a network, and replacing the cable in this location can be one troubleshooting option.

Cable termination

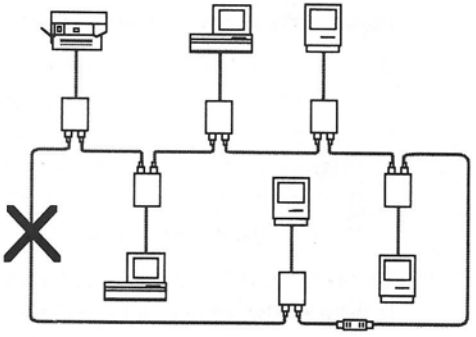
LocalTalk and EtherTalk cabling systems use a **bus** topology, in which devices are strung out along a cable that terminates with a connector box (or terminator for EtherTalk) at each end. A properly terminated LocalTalk network has no dangling cable extending beyond the terminating connector box.



EtherTalk requires a separate terminator at each end of a network segment. EtherTalk is available on various cable media (including twisted-pair and fiber-optic cables) that have different termination requirements. The following represents a terminator for thin Ethernet cabling. Refer to the appropriate installation instructions for the termination requirements of your cable medium.



LocalTalk and EtherTalk do not support a continuous loop of cable, nor any T-shaped arrangement of devices. This means that each cable end of each network must be properly terminated with a node for the network to operate correctly.



Network maintenance with Inter•Poll

The larger and more elaborate your internet, the more necessary it becomes to perform occasional checks of network integrity. These maintenance checks can be regularly scheduled, or simply worked into the ongoing routine of the network administrator. Either way, they should be frequent enough to keep network maintenance in a *preventive* mode, rather than a problem-driven, reactive mode.

How frequent is "frequent enough"? In a medium-sized internet of two to five networks with a few dozen nodes, preventive maintenance checks might be performed once or twice weekly. In a larger internet spanning many zones, networks, and devices, a daily scheduled check of network integrity may be appropriate. A key determinant will be the stability of the network configuration—that is, how often devices are being moved, added, or deleted.

By applying preventive maintenance practices to your network, problems in communication can often be detected and repaired before they interfere with user needs.

❖ *Note:* To interpret Inter•Poll's diagnostic output, you'll need to consult a current reference source listing the zones, networks, and devices that should be connected to your internet. This reference can be a network map, as described in Chapter 3, or a combination of the network map and printed listings, described in "The File Menu" in Part II.

To test network integrity, start Inter•Poll on the network administrator's workstation and perform the checks described below.

Step 1: Check zone listings

The Select Zones listing in the Network Search window lists all zones that are visible to Inter•Poll.

1. Scroll through the zone listing to make sure that all are present, using either the network map or a printed zone list to check for names missing from the display.
2. If one or more zone names are missing from the display, go to the "Missing Zone" scenario in the section of this chapter titled "Network Troubleshooting with Inter•Poll."

Step 2: Check networks

Once zone integrity has been verified, proceed to checking networks. To do this, execute an Inter•Poll search of each zone in the internet, one zone at a time, and repeat the procedure for each. In a smaller internet it may be appropriate to check all zones in a single search. Note, however, that an all-zones search will be time-consuming and could gather more information than is practical to interpret at one time. Network checks may be better accomplished by testing zones individually.

Perform a network search to display a device list that includes all networks visible to Inter•Poll.

1. **Searching a single zone:** Click the desired zone name in the Select Zones listing, and after performing the steps below, repeat the procedure for each zone name listed.

   Searching all zones: Shift-click through the entire Select Zones listing to highlight all displayed zone names.

2. Set the sort order to Net to produce a device list in which devices are grouped by network.
3. With the All Named Devices option selected, click OK to begin the search and display the device list.
4. Scroll through the device list, checking the Nets column to make sure that all networks are present. Refer to the network map or a printed device list to check for any network numbers missing from the display (in a single-network installation, the network number will be listed as zero).
5. If one or more network numbers are missing from the display, go to the "Missing Network" scenario in the section of this chapter titled "Network Troubleshooting with Inter•Poll."

Step 3: Check network paths

Once the integrity of the internet has been verified, proceed to check the integrity of individual networks by testing paths to devices at the extremities of these networks. By targeting the endmost devices in this way, you can ascertain that the path through an individual network is free of breaks.

While it may be too time-consuming to test all network paths on a large internet this way, it's good practice to make such checks part of the preventive maintenance routine, rotating the target networks each time the checks are performed.

Use the network map to determine the node at the farthest extremity of a network to be tested. Then test the node's response to verify that the access path is clear. If the network is linked by a bridge connected at the network's center rather than at one end, then devices at both extremities should be tested to assure network integrity.

1. Display an Inter•Poll device list for the desired network and scan device names visually to identify incomplete networks.
2. If one or more devices are missing from the list or not responding to the search, go to the "Missing Device" scenario in the "Network Troubleshooting with Inter•Poll" section of this chapter.

Step 4: Test devices

Finally, testing individual devices with loopback tests allows you to check for data loss and for the possibility of network path changes due to bridge malfunctions or traffic congestion.

You must select a device to target for testing before the Device Test window may be displayed. The devices you select will be determined by the network regions you wish to test in your preventive maintenance routine.

- **Checking for lost packets:** The Device Test window contains a table of test statistics that displays the number of packets sent, received, and lost in any test. Consult this display when checking network integrity, as packet loss during a test can indicate trouble in the loopback path.

  In this event, perform loopback tests to individual devices along the path until you isolate the point where packet loss occurs. Then perform local troubleshooting at this location.

  ❖ *Note:* Inter•Poll considers a packet lost if it has not completed a loopback test within the timeout period designated in the Device Test window (described in Part II). If this timeout period is set to the minimum (0.2 seconds), or is very low, then packet loss is to be expected. However, if a given test normally results in successful loopback completion, an observation of packet loss indicates trouble.

- **Checking hop count:** Hop counts to the targeted device are displayed during loopback testing. A regular part of preventive maintenance is maintaining awareness of hop counts to devices during loopback tests.

  For example, if a workstation on a network that is normally two hops away suddenly registers a hop count of four, this would indicate that a bridge malfunction or network break is forcing the packets onto an alternate route (this can only occur if your network layout permits more than one route to points on the internet). In this event, consult the network map to determine the normal route to this device, and perform loopback tests to individual devices along this route until you isolate the break point.

  ❖ *Note:* If the network on which Inter•Poll is running contains more than one bridge, the hop count may vary by *one* from time to time, depending on the route most recently identified by AppleTalk routing protocols. This variability will not exceed one hop.

  See the discussion of hops under "Test Results" in the section titled "The Device Test Window" in Part II.

The next section takes the principles of network maintenance a step further into the day-to-day process of troubleshooting—applying the principles in response to actual network problems.

Network troubleshooting with Inter•Poll

This section is a reference source to help you troubleshoot networks and internets. Keep in mind that since every AppleTalk network system is set up in a unique location with a unique layout of nodes, every network problem is also unique. A troubleshooting guide can provide strategies for solving these problems, but it cannot be a list of canned solutions.

Basic troubleshooting

Network problems share many common traits. Most involve a break in the network path occurring at a point of connection, or one of several common software problems.

Likewise, troubleshooting remedies for dealing with these problems will also share many common traits. The most basic approach to *all* network troubleshooting can be reduced to the general steps below.

1. **Clearly define the symptoms of the problem.**
2. **Verify that these symptoms are in fact network-related.**
3. **Determine which networks and devices are involved.**
4. **Isolate the location of the problem through diagnostic tests.**
5. **Visually check and correct any hardware problems at the location.**
6. **Correct any software problems at the location.**

Troubleshooting strategy

So far this manual has shown you how Inter•Poll works, has outlined certain types of problems you may encounter with the network and why they occur, and has provided guidelines for preventive maintenance. Now, when trouble is at hand, how will these pieces fit together into a solution?

- **Look at the big picture:** It's helpful to maintain a conception of the total network when addressing any malfunction. *The network map is your most useful ally in visualizing the relationship between devices.*
- **Use a logical top-down sequence:** The troubleshooting process is a sequential series of tasks designed to isolate the location of a problem. It begins with an Inter•Poll device listing and, depending on the results of this search, proceeds to localized testing at the network or device level.

Internet checks

1. Make sure affected devices are on the same or interconnected networks.
2. If all devices on a network are missing from a device list, the problem is most likely to be bridge-related.
3. Make sure that bridges have been properly configured. Check operation and installation manuals for bridge hardware and software.
4. If the network medium is Ethernet, check the EtherTalk hardware and software installation, and refer to the appropriate documentation.

Workgroup checks

1. Check for disconnected cables.
2. Check and tighten all network connections, including connector boxes and cable extenders.
3. If the medium is LocalTalk, or thick or thin Ethernet cable, check that the network is installed with devices in a line, not a closed loop (other Ethernet media may have different layout conventions).
4. Check for proper network termination, as described in the section "Cable Termination" earlier in this chapter.

Localized device checks

1. Is the affected device turned on?
2. Is the affected device attached to the network?
3. If the medium is LocalTalk, is the LocalTalk connector attached to the printer port?
4. Check for appropriate versions of system software.
5. Check for correct LaserWriter driver software.
6. If the device is a Macintosh, make sure AppleTalk is set to Active in the Chooser.
7. If the device is a Macintosh on EtherTalk, then make sure the EtherTalk option is selected in the Control Panel's Network options (refer to the *EtherTalk User's Guide* for details).

The sections that follow take you through a sequence of troubleshooting steps in scenarios of the most common network malfunctions:

- ☐ missing zone
- ☐ missing network
- ☐ missing device
- ☐ intermittent loss of service
- ☐ isolating internet breaks

Missing zone

Symptoms

One or more zones are missing from a user's Macintosh Chooser window or the Network Search window's zone display (this only applies to networks containing more than one zone).

Procedure

1. Consult the network map to determine the location of the missing zone(s) relative to the Inter•Poll workstation.
2. Select the zone that is adjacent to the missing zone and nearest to the Inter•Poll workstation, and perform an All Named Devices listing to reveal the possible break point. Verify that all networks are present in this adjacent zone.

3. Determine from the network map which device is the last responding node on the path to the missing zone.
4. Go to the location of this last device and follow local troubleshooting guidelines:
   - ☐ Check connectors and cable termination.
   - ☐ Check the bridge connecting the missing zone to the "visible" part of the internet. Refer to the owner's manual for this device.
5. Repair or replace any malfunctioning device or cables and retry listing the zone.
6. If you find no visible break and local checks of hardware and cabling fail to solve the problem, install Inter•Poll on a Macintosh connected inside the nonresponding zone (preferably the Macintosh farthest from the zone's connecting bridge).
   - ☐ Perform an All Named Devices listing.
   - ☐ Compare the device list with the network map.
   - ☐ If any device within the zone is missing from the list, follow local troubleshooting guidelines at that location.
7. If no trouble source is located in step 6, perform loopback tests from the Inter•Poll workstation inside the zone.
   - ☐ First check the bridge connecting the zone to the internet.
   - ☐ If you receive no response, test each contiguous device starting from the bridge until the break is isolated.

   See the instructions in Part II, "The Device Test Window."

Missing network

Symptoms

One or more networks are missing from the Inter•Poll device list.

Procedure

1. Consult the network map to determine the location of the missing network relative to the Inter•Poll workstation.
2. Perform an All Named Devices listing of the zone containing the missing network, and then determine from the network map which device is the last responding node on the path to the missing network.
3. Go to the location of this last device and follow local troubleshooting guidelines:
   - ☐ Check connectors and cable termination.
   - ☐ Check the bridge connecting the missing network to the "visible" part of the internet. Refer to the owner's manual for this device.
4. Repair or replace any malfunctioning device or cables and retry listing the network.
5. If you find no visible break and local checks of hardware and cabling fail to solve the problem, install Inter•Poll on a Macintosh connected inside the nonresponding network (preferably the Macintosh farthest from the network's connecting bridge).
   - ☐ Perform an All Named Devices listing of the local zone (select sorting by Net to make the device list easier to read).
   - ☐ Compare the device list with the network map.
   - ☐ If any device within the network is missing from the list, follow local troubleshooting guidelines at that location.
6. If no trouble source is located in step 5, perform loopback tests from the Inter•Poll workstation inside the network.
   - ☐ First check the bridge connecting the network to the internet.
   - ☐ If you receive no response, test each contiguous device starting from the bridge until the break is isolated.

   See the instructions in Part II, "The Device Test Window."

Missing device

Symptoms

One or more devices are missing from the Inter•Poll device list.

Procedure

1. Consult the network map to determine the location of the missing device(s) relative to the Inter•Poll workstation.
2. Go to the location of the missing device(s) and follow local troubleshooting guidelines:
   - ☐ Check connectors and cables.
   - ☐ If the device is a Macintosh, make sure the LocalTalk connector is attached to the printer port.
   - ☐ If the device is a Macintosh, make sure it's running the correct version of the Responder software, and that this program is located in the System Folder.
   - ☐ If the device is a Macintosh, make sure AppleTalk is set to Active in the Chooser window.
3. Repair or replace any malfunctioning connectors, cables, or software, and retry listing the device.
4. If you receive no response, and if you can't see any network services from the affected workstation's Chooser, the problem may be caused by the device's internal network connection hardware. Try substituting a known working device, and consult your hardware service representative about the malfunctioning unit.

Intermittent loss of a network service

Symptoms

One or more workstations are receiving erratic, slow, or occasionally interrupted service from a LaserWriter or file server.

Procedure

1. Display an Inter•Poll device list to verify that the affected devices are registering properly.
   - ☐ If a device is missing from the list, follow the procedure under "Missing Device."
   - ☐ If all devices are listed, the symptoms may be the result of an intermittent connection. Follow the procedure below to isolate the location and troubleshoot.
2. Consult the network map to determine the location of the affected workstation relative to the offending printer or server.
3. Take a copy of Inter•Poll to the affected workstation, and from there begin testing devices in the path to the printer or server. Perform a loopback test on the nearest device first, and test successive devices until results indicate a loss of test packets. This will isolate the network segment where the intermittent break is originating.
4. Perform local troubleshooting at the location of the intermittent break. Refer to the section of this chapter called "First Aid: Hardware" for more information on intermittent connections.

Internet break example

Consider the following example of a break on a multizone internet. In fully functional condition, the Inter•Poll device listing for this internet would show the following zones and networks:

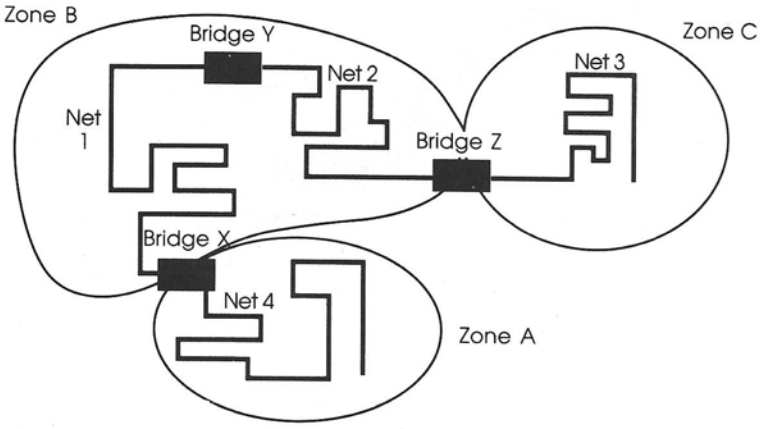
❖ *Note:* The network administrator's workstation is located on Network 4.

Zone	Network
A	4
B	1,2
C	3

For illustration purposes, a break in this example results in a device list showing the following zones and networks:

Zone	Network
A	4
B	1

To interpret such information, it's necessary to check the network map for the internet layout. The network map shows the following:

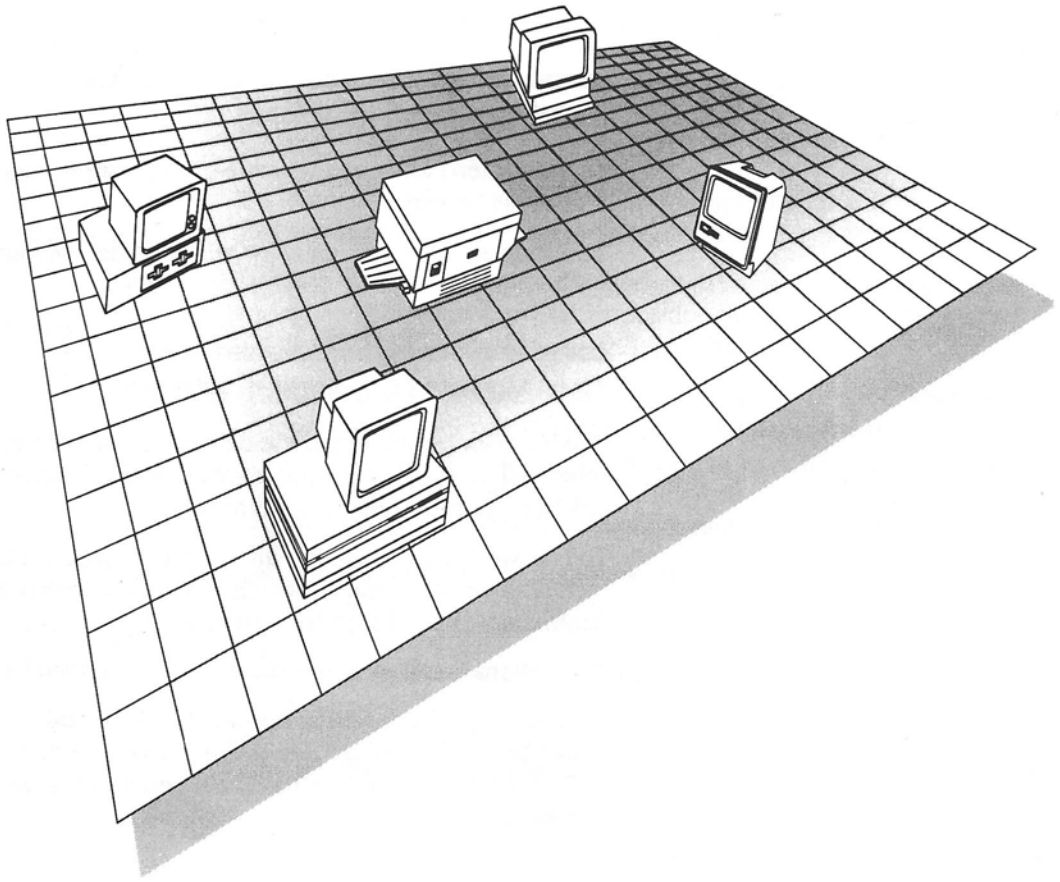


The probable location of the break is now evident. For the administrator's workstation to list networks 4 and 1, yet not 2 or 3, a break must have occurred somewhere at the link between networks 1 and 2.

There are several connection points along this link, and all should be checked. Particularly, Bridge Y is at this location, and is a likely cause of the problem. This device should be checked for loose connections, tested, and replaced if necessary.

Part II

Inter•Poll Reference



This Inter•Poll reference section describes each screen option and menu command that you will encounter in the course of operating Inter•Poll.

The section is divided into the seven principal program components of Inter•Poll:

- the Network Search window
- the Device List window
- the Options menu
- the Device Test window
- the File menu
- the Special menu
- the Edit menu

Starting and quitting

To start Inter•Poll, simply double-click its application icon on your Macintosh screen.

To exit from Inter•Poll, choose Quit from the File menu.

The Network Search window

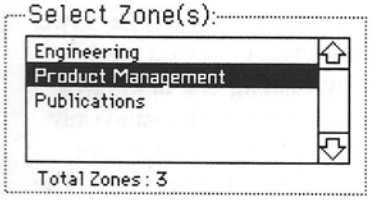
The Network Search window is displayed each time you start Inter•Poll, and it may also be invoked from the Options menu at any time during program operation.

The Network Search window allows you to specify search criteria including selected zones, search duration, sorting order, and parameters of devices to be searched.

The options available in this window are described below.

❖ *Note:* The default setting for each option is indicated, but these can be superseded by user-defined default settings with the Save Preferences option (see the File menu description later in this section).

Select Zone



The zone listing in the upper-left corner of the window displays all zones currently visible to the Inter•Poll workstation. The device search will cover any zone(s) highlighted on this list. The default zone is always the zone in which the Inter•Poll program is running.

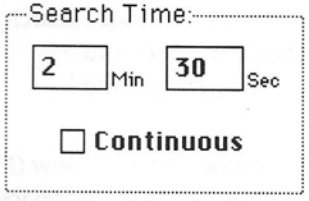
If your network is a single (nonbridged) network with no defined zones, this box will display "No Zones."

Select one zone by positioning the pointer over the desired zone name and clicking the mouse button once.

Select one or more additional zones by Shift-clicking any additional zone name(s).

Select *all* zones in the network by shift-clicking through the list until all zones are highlighted.

Search Time



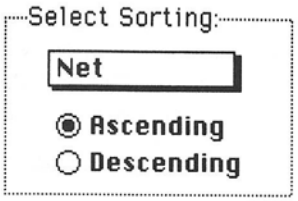
The duration of the device search may be specified in minutes and seconds.

To enter the desired search time, select the currently displayed time and type the new value over it, or position the pointer to the right of the displayed value, backspace, and type the new value.

❖ *Warning:* The Continuous time option extends network scanning indefinitely, until you stop the search manually. Do *not* select this option under normal circumstances, as searching can create considerable network traffic. (Continuous searching may be a useful option for extended testing during nonbusiness hours.)

Search duration should be set to the time that your experience has shown is needed to complete the particular type of search. This time will vary depending on network size and the number of zones selected, as well as the search characteristics defined with the Settings feature (see "The Special Menu," later in this section). The default search time of two minutes and thirty seconds should be sufficient for a large internet.

Select Sorting



Device lists can be sorted by Network, Node, Socket, Name, Type, or Zone. The order in which the device list will be sorted can be specified as Ascending or Descending by clicking one of the two radio buttons in this box. A sort order selection will be valid only if the corresponding column is displayed in the device list (see the Device List Columns command, described in the section "The Options Menu").

To select the search field on which to sort, place the pointer over the currently displayed field in the box, and press the mouse button to display a pop-up menu containing the sorting choices. Then drag the pointer to the desired selection and release the mouse button.

The default sort is by Network, in Ascending order.

Search for All Named Devices

When the All Named Devices option is selected, the device search will be executed with no further search criteria entered, and the resulting list will show all responding devices in the specified zones.

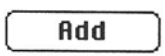
Click the All Named Devices button at the left side of the window (if not already selected) to confirm that the search will have no device match parameters.

The default setting for this option is All Named Devices.

Search for Devices Matching

Click the Devices Matching button to add specific search criteria for the devices you wish to list. The following sections describe the search criteria available.

The Add button



Since multiple search criteria may be entered for a single search, each must be added individually to the list of search parameters.

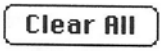
Click the Add button after each match selection to register the selection in the Search Criteria box at the bottom of the window.

The Clear button

The Clear button allows you to delete individual search criteria from the Search Criteria box, while retaining the balance of the parameters unchanged. If you have made more than one selection in a given field, the Clear button will clear all selections in that field.

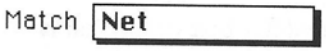
To clear, use the mouse to select the parameter you wish to delete, and then click the Clear button.

The Clear All button



When clicked, the Clear All button deletes all selected parameters from the Search Criteria box.

Select match parameter(s)



The Match option allows you to specify parameters to limit the devices that Inter•Poll will list (for example, devices whose type is Macintosh Plus only).

Drag through the pop-up menu to the right of the word Match, until the pointer is over the desired parameter. The options are:

Net: List only devices attached to a specific network number.

Name: Search for a specific device by name.

Type: List only devices matching a specific type.

Unnamed: Include unnamed devices (devices not responding with name identification).

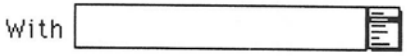
Important

Selecting the unnamed devices parameter produces a device list that contains all active devices Inter•Poll encounters, including those incapable of responding with an AppleTalk name.

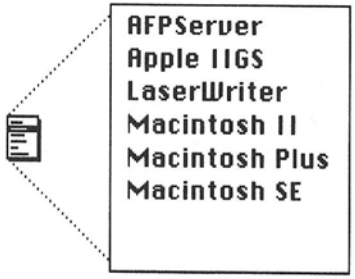
Note, however, that a network will not appear on a device list if it contains only unnamed devices. This is because Inter•Poll can only acquire network numbers—needed to recognize a network—from the responses of named devices running on the given network.

This limitation can be bypassed if you already know the network number and simply perform a "Devices Matching" search, with the network number manually entered in the Search Criteria field.

Enter match qualifier(s)

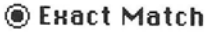


Enter the qualifier that corresponds to the selected parameter in the box labeled "With" following the Match pop-up menu. For example, if you wish to list LaserWriters and have selected the parameter "Type," you would enter the qualifier "LaserWriter" in this box, or select the type using the **reference pop-up menu** described in the following paragraph.



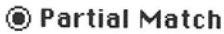
Reference pop-up menu: To the right of the qualifier box is an icon for a reference pop-up menu. Click this icon to display a list of all available choices for the current parameter. Again, if the parameter were Type, this list might include LaserWriter, AppleShare Server, and Macintosh Plus. If the parameter were Net, the list would display all known network numbers. The items displayed in this list represent the actual ones currently on your network system.

When you choose an item from the pop-up menu, it is automatically entered into the match qualifier box (Inter•Poll is actually performing a network search to find the devices listed in this pop-up menu; it may take a few moments before the device you seek appears on the list).



Exact or Partial Match: Click the Exact Match button to list only devices that match the given parameter and qualifier exactly.

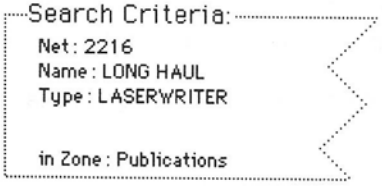
Click the Partial Match button to list all devices whose name (or number, depending on what you are matching) contains the character string entered for the given parameter and qualifier (for example, "Mac" would match Macintosh Plus, Macintosh II, and so on).



Partial matching is the default setting for this option.

❖ *Note:* Be sure to click the Add button following the definition of each device match parameter.

Additional parameters



After you click the Add button, the parameter and qualifier will appear in the Search Criteria box at the bottom of the window.

To select additional parameters—for example, to specify the network number *and* device type matches to list—simply repeat the procedure used for the initial parameter, and click the Add button once more.

Inter•Poll will allow you to add up to four search criteria for each selected parameter.

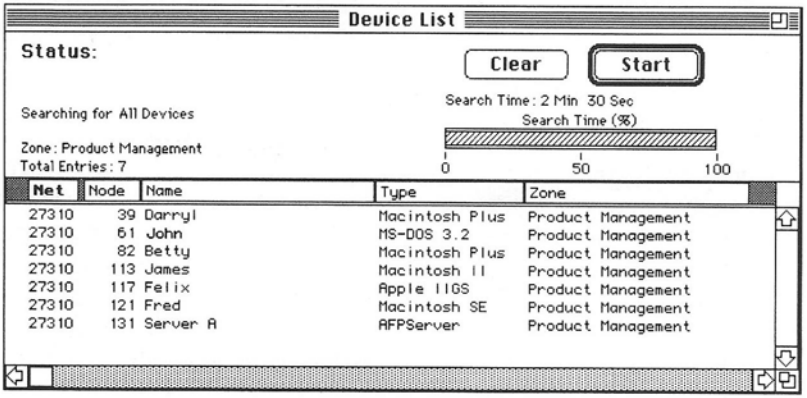
Start search

When you have selected all search criteria and entered matching parameters, you may begin the network search.

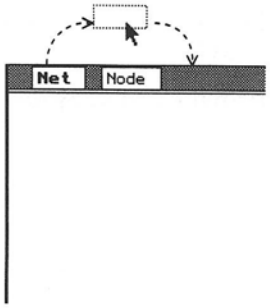
Click Start or press Return to initiate the search and display the Device List window.

The Device List window

Once the network search is initiated, Inter•Poll displays the Device List window. The search status is displayed in the upper-left portion of the window, and elapsed search time is tracked by the timer bar at the upper right.



The Device List window displays the results of the network search in columns that can be formatted interactively, as described in the following sections.



Move a column

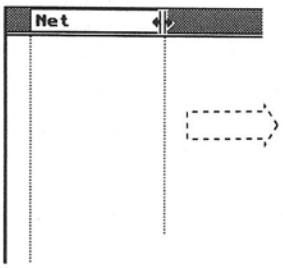
Position the pointer inside any column heading label; the pointer changes to a two-headed arrow. Now you can drag the label from its current position to the desired new position.

The page will automatically reformat to display the column contents under the new heading label position.

Delete a column

Position the pointer inside any column heading label and drag the label from its current position toward the top of the screen, or until the gray dotted outline of the label disappears.

The contents of the entire column will disappear from the page (you can always recover a deleted column by using the Device List Columns command from the Options menu).



Change column width

Position the pointer on the left or right edge of any column heading label; it will turn into a bidirectional pointer. Now you can drag the edge horizontally across the heading bar. The column edge will follow the pointer until released, and the entire column will be widened accordingly. Use the same technique to reduce column width.

Stop and restart search

While the network search is executing, you can stop it at any time by clicking the Stop button in the upper-right corner of the screen. This causes the button to toggle to a Start button, which may then be clicked at any time to resume the search with the same parameters as were previously in effect.

The Options menu

Most Inter•Poll program options are directly accessible in the program's various windows. In addition, the following commands are presented in the Options menu:

- Network Search
- Device List Columns
- List Aliases
- List Using Hexadecimal Numbers
- Find Entry
- Find Same

These commands are described in the following sections.

Network Search...

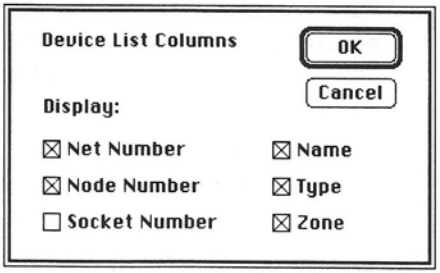
This command invokes the Network Search window, described in the previous section.

The Network Search window allows you to enter search criteria for device lookups on the network, and is displayed automatically at program startup. Use this command to return to the Network Search window at any time to redefine your search.

When you select this command while already displaying the Network Search window, Inter•Poll refreshes the current zone listings in the window's Select Zone box.

Device List Columns...

When you choose this command, the following box is displayed:



Use this box to designate which data fields will be displayed in columns in the Device List window.

To add a column, position the pointer in the check box next to the desired field name and click. An "X" will appear in the box.

To delete a selected column (already marked with an "X"), click in the check box next to that field name.

When your column selections are complete, click OK or press Return to confirm the settings and return to the previous window.

❖ *Note:* Device List columns can also be deleted, moved, and formatted directly from the Device List window. See the earlier section, "The Device List Window."

List Aliases

Aliases are device names created when two or more network functions located in the same device are recognized by Inter•Poll as individual devices. This could take place if, for example, a Macintosh were being used concurrently as a file server and a print spooler. Each of these is considered a "device" by Inter•Poll.

As a result, the device list would contain two entries having different device names and types, but the *same network and node numbers.*

The default setting of List Aliases is On. Click this option to toggle off the alias listing feature when desired, and click it again to turn it back on.

List Using Hexadecimal Numbers

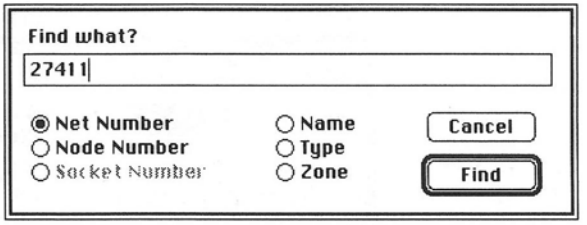
When selected, this option changes the display of network, node, and socket numbers from decimal to hexadecimal (base 16), and back to decimal when deselected.

This is of value when you want to correlate Inter•Poll network listings with other sources that may list device identifiers in hexadecimal notation; for example, certain bridge configuration programs.

Find Entry...

The Find Entry command allows you to locate an entry quickly on a device list by typing the information that you want to look for.

When you choose the Find Entry command, the following dialog box is displayed:



Click the radio button for the device list column that corresponds to the information you want to type. Then type the entry identification in the box, and click OK or press Return to search for the entry. (Inter•Poll will search for a partial match if no exact match is found.) The device list will be redisplayed with the desired entry highlighted—if necessary, advanced or backed up to the appropriate section of the list. This feature is useful for finding entries on long device lists.

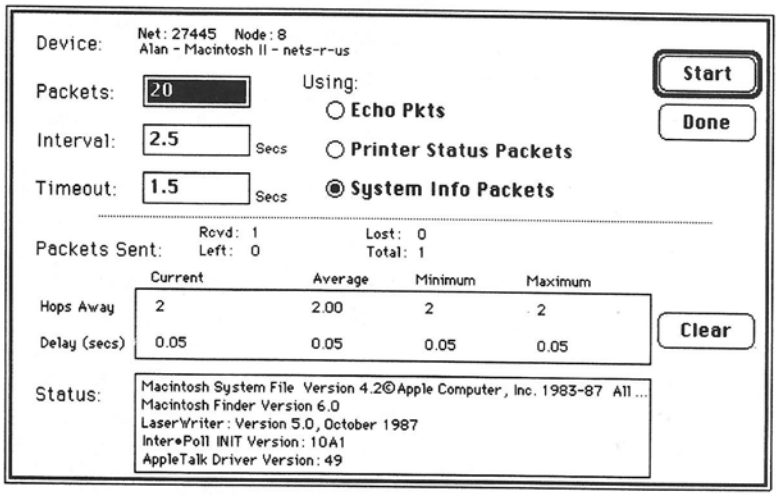
As an alternate way to access this command, you may double-click on any of the column headings to display the Find Entry dialog box with the particular column title selected.

Find Same

The Find Same command allows you to instantly redisplay the most recent device list entry located by the Find Entry command. To do this, choose Find Same from the Options menu, and the device list will be redisplayed with the desired entry highlighted—if necessary, advanced or backed up to the appropriate section of the list.

The Device Test window

The Device Test window, from which loopback tests are initiated, can be invoked either from the Device Test command in the Special menu, or by double-clicking any device listed in the Device List window. In either case, program interaction is identical. The following window is displayed:



Loopback tests return information on link integrity and response time between the Inter•Poll workstation and the targeted device. By sending packet tests to a sequence of devices along a network, it's possible to determine at which point in the network a transmission problem is originating.

The following are valid setting ranges for loopback tests:

- **Packets:** 1–32,767
- **Interval:** 0–99,999.99 seconds
- **Timeout:** 0.2–99,999.99 seconds

The interval time is the delay between packets sent. An interval time of zero will cause the system to send packets as quickly as it is capable (this may be useful in network tests requiring a very high traffic load). The timeout value is the length of time that Inter•Poll will wait for a loopback response before declaring a packet lost.

Packet types and functions

The packet types described below can be selected in the Device Test window. Click the radio button next to your desired selection to activate that packet type.

Echo packets

This packet type tests link integrity between the Inter•Poll workstation and any other workstation, as well as many server types. The information returned includes the distance in hops, time delay in seconds, and number of packets sent, received, and lost.

Short or long packets: When you select echo packets, options are displayed for short or long packet types. The default type, short packets, would normally be used to check node connectivity. Long packets would be useful, for example, to check packet loss due to network congestion by artificially loading network traffic.

Printer status packets

This packet type tests LaserWriters and other devices that communicate using the Printer Access Protocol (see Appendix A for AppleTalk protocol information). In addition to distance, time, and number of packets, printer status packet tests return the printer status messages normally associated with LaserWriters (for example, those indicating a job in progress, the originating user name, and so on).

System information packets

System information packet tests query Macintosh nodes running Responder for current system software versions. Version numbers are returned for the System, Finder, Responder, AppleTalk driver, and LaserWriter driver of the targeted node.

Test results

Received

This value shows the number of sent packets that have been returned to the Inter•Poll workstation by the target device, within the timeout period specified in the Device Test window.

Lost

This value shows the number of sent packets that have *not* been returned to the Inter•Poll workstation by the target device. Lost packets are those not returned within the specified timeout period.

Left

This value counts down the number of packets remaining to be sent to the target device.

Total

This value shows the total number of packets that have been sent to the target device.

Hops away

This statistic reports the path, in number of bridge crossings, from the Inter•Poll workstation to the tested device.

❖ *Note:* The number of hops to a given device depends on the route taken, which in turn depends on the network address tables furnished to bridges by AppleTalk's Routing Table Maintenance Protocol. If the network you are connected to contains more than one bridge, the hop count may vary by *one* from time to time, depending on the route most recently identified by the routing protocol. This variability will not exceed one hop.

Delay

This value shows the round trip loopback time, in seconds, that was taken by each packet to complete the test to the target device.

Test commands

Start/Stop

Once the packet type has been selected, click the Start button or press Return to begin testing. The button then toggles to Stop. The Stop button can be clicked at any time to interrupt testing.

Clear

Click the Clear command to reset test results to zero. If this is not done, cumulative totals will be tallied as long as tests of the current device are repeated.

Done

Click the Done button to exit from the Device Test window and to return to the Device List window.

The File menu

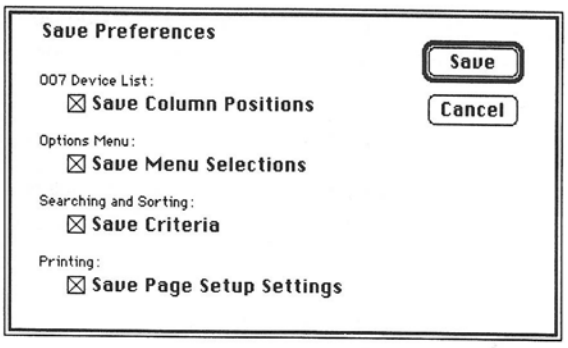
Commands from the File menu allow you to save or print Inter•Poll device lists, and to save Inter•Poll program parameter settings.

Save Preferences...

This command displays the Save Preferences dialog box. Program settings selected in this box will be stored and reused each time Inter•Poll is started. The Inter•Poll Preferences file is stored in the System Folder. One such file is stored automatically by Inter•Poll, regardless of whether the Save Preferences command is used.

The following settings may be stored:

- **Column positions:** the order and width formats of the displayed columns in the Device List window
- **Menu options:** the program parameters selected via pull-down menu commands, including parameters changed in the Internal Settings dialog box and the Device Test window
- **Sorting options:** the device list sort parameters
- **Page Setup settings:** the page parameters selected for printing device lists



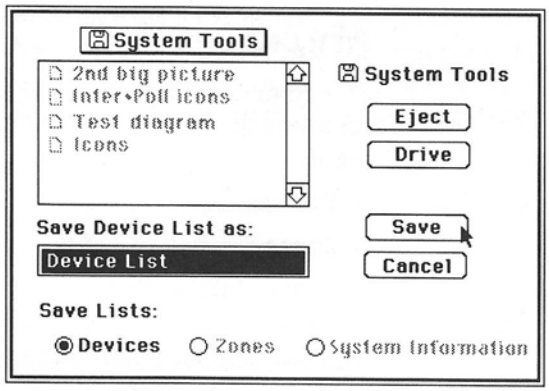
Click the check box next to each setting you wish to save. An "X" will appear in the box to confirm the selection. To cancel saving a setting, click in its box again to remove the "X".

Save List...

This command allows you to save a file copy of the currently displayed device list.

Choose the Save List command to invoke the standard Save As dialog box, shown on the facing page. One of the three following save options may be selected:

- ☐ Devices
- ☐ Zones
- ☐ System Information

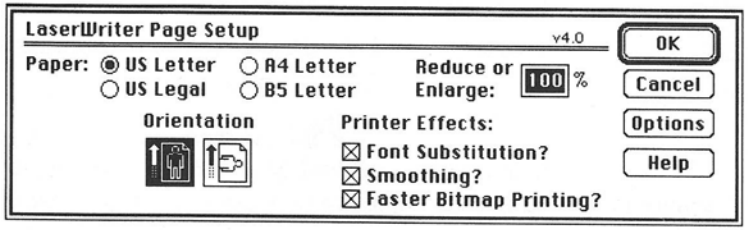


Click the radio button next to the device list parameter you wish to save (only *one* parameter may be selected). Select the folder in which you want to store the device list from the displayed listing. Then click Save. You may only select a list type for which a list has been produced in the current Inter•Poll session.

The list is saved as a tab-delimited text document, which can later be displayed or printed using any application capable of opening a Macintosh text file (for example, MacWrite or Microsoft Excel).

Page Setup...

Use the Page Setup command to prepare for printing a device list. This command invokes the standard Page Setup dialog box, with all options associated with the currently selected printer.

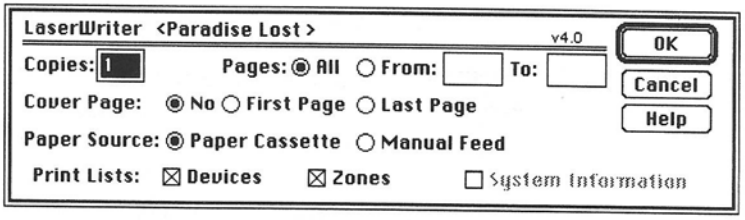


❖ *Note:* Be sure to select the horizontal page orientation if there are several wide columns in the device list to be printed.

Print Lists...

This command displays the standard Print dialog box, with options for selecting one or more of the following items to be included on the list:

- ☐ Devices
- ☐ Zones
- ☐ System Information


LaserWriter <Paradise Lost>
v4.0
OK
Copies: 1
Pages: ◉ All ○ From: To:
Cancel
Cover Page: ◉ No ○ First Page ○ Last Page
Help
Paper Source: ◉ Paper Cassette ○ Manual Feed
Print Lists: ☒ Devices ☒ Zones ☐ System Information

Click the check box preceding the desired selection(s), make any desired changes to the default printing parameters, and click OK to send the device list to the printer. Print options will be dimmed if the corresponding information is not in the current list.

Quit

Choose Quit from the File menu to exit from Inter•Poll and return to the Macintosh Finder.

The Special menu

The Special menu contains commands associated with testing and reporting on network devices.

Device Test...

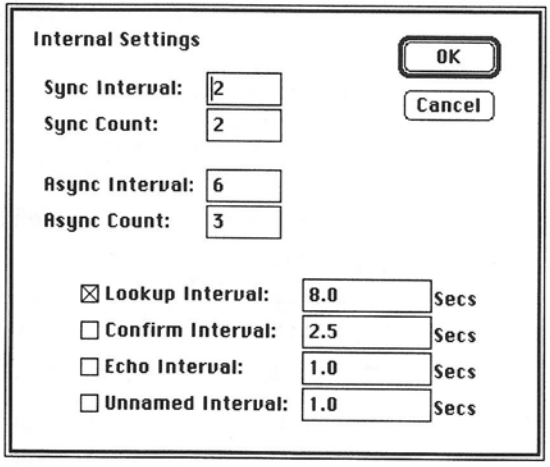
This command invokes the Device Test window, described earlier. The Device Test command in the Special menu provides another way to access this window.

To display the window, select any device on the displayed list, and then choose the Device Test command to test this node with loopback tests. (This supplements the access method of double-clicking any device on the list to access the test window.)

Settings...

This command displays the Internal Settings dialog box, which contains settings for the frequency, duration, and type of device lookups performed in a network search.

❖ *Note:* The Settings command is an advanced feature of Inter•Poll, intended for fine-tuning search performance. For further explanation of how AppleTalk protocols support this feature, refer to the discussion of Name Binding Protocol (NBP) lookups in *Inside AppleTalk.*



Lookup interval and count

The top four settings in this window determine the number of lookups and the duration of the delay interval between lookups. The network search consists of a synchronous lookup sequence, in which all selected zones are polled without interruption, followed by an asynchronous lookup sequence performed in background mode (that is, subject to priority interrupts).

The Inter•Poll lookup is broadcast to each network, not directed to individual devices. Lookup duration is measured in the standard Macintosh time unit of "ticks," signifying 1/60th second.

The settings are:

- Sync Interval
- Sync Count
- Async Interval
- Async Count

❖ *Note:* The valid range for interval and count settings is 1–16.

Each has a default value, as shown in the screen diagram. Change these settings to improve search accuracy if, for example, network interference noise is causing lookup packets to be lost. If such interference exists, it may be useful to increase both sync and async intervals and counts. A recommended guideline is to try doubling the default values of these settings.

Warning Increasing the lookup count and/or interval will also increase the time required to complete a network search.

Lookup type selection

At least one lookup interval must be selected from this list for Inter•Poll to be operational.

- Click the check box to the left of the selection to activate the lookup type.
- If desired, change the interval time for any lookup type that has been activated.
- The valid range in seconds for these intervals is 0.1–99,999.99.

One or more of the following lookups may be selected:

Lookup Interval: This option determines the wait time between asynchronous lookups.

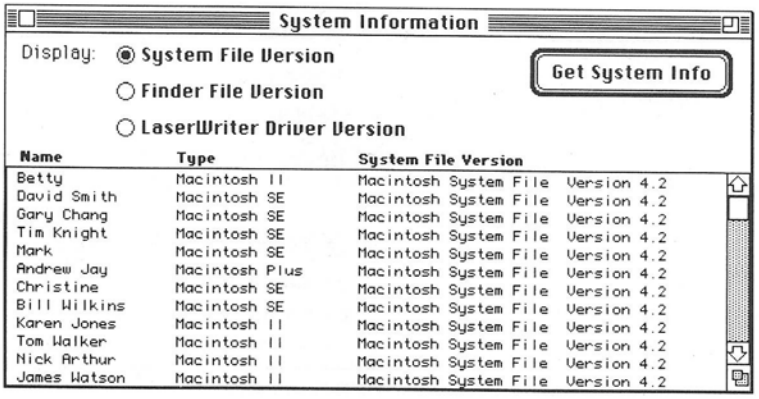
Confirm Interval: This option implements a device confirmation check, which verifies that each device on a list is still responding. This eliminates device listing duplications caused when devices are reinitialized and change their names. The Confirm Interval is set *automatically* when Continuous Search is selected in the Network Search window, and can also be set *manually* by making this selection.

Echo Interval: This option broadcasts an echo packet to all zones selected in the current search. Any device running Responder or AppleTalk driver version 4.1 and above will respond. This differs from the lookup broadcast in that it is directed to known networks on the current device list. Responses include the device node number and network number only.

Unnamed Interval: This option allows the detection of devices that have neither the Responder software nor Echo Protocol capability. The unnamed devices can only be detected on the network on which Inter•Poll is running; this lookup will not operate across an internet bridge.

Get System Info...

The Get System Info command in the Special menu displays Inter•Poll's System Information window. From this window you may list currently running software versions of the System, Finder, and LaserWriter driver files for each active Macintosh on the network.


System Information
Display:
System File Version
Finder File Version
LaserWriter Driver Version
Get System Info
Name
Type
System File Version
Betty Macintosh II Macintosh System File Version 4.2
David Smith Macintosh SE Macintosh System File Version 4.2
Gary Chang Macintosh SE Macintosh System File Version 4.2
Tim Knight Macintosh SE Macintosh System File Version 4.2
Mark Macintosh SE Macintosh System File Version 4.2
Andrew Jay Macintosh Plus Macintosh System File Version 4.2
Christine Macintosh SE Macintosh System File Version 4.2
Bill Wilkins Macintosh SE Macintosh System File Version 4.2
Karen Jones Macintosh II Macintosh System File Version 4.2
Tom Walker Macintosh II Macintosh System File Version 4.2
Nick Arthur Macintosh II Macintosh System File Version 4.2
James Watson Macintosh II Macintosh System File Version 4.2

List System file versions

Click this button to display a list of all active Macintosh nodes and their current System file version numbers.

List Finder file versions

Click this button to display a list of all active Macintosh nodes and their current Finder file version numbers.

List LaserWriter driver versions

Click this button to display a list of all active Macintosh nodes and their current LaserWriter driver version numbers.

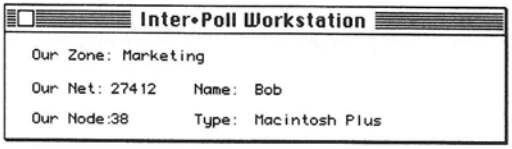
Get system information

After selecting which software type to list, click the Get System Info button, or simply press Return, to begin scanning the active device list. Inter•Poll scans the devices and returns the information requested. Once the entire list has been scanned, the Get System Info button will flash and the scan will stop. To repeat the scan, click this button again.

Inter•Poll Workstation

The Inter•Poll Workstation window displays identifying data about the workstation on which Inter•Poll is currently running. The following information is provided:

- zone name
- network number
- node number
- device name
- device type



The Edit menu

The standard Macintosh editing functions are supported in the Inter•Poll Edit menu. However, Inter•Poll is not an editing-intensive application, and most program input will be performed without editing.

Editing can be performed only on text you type in, not text listed by the Inter•Poll search function (such as the device list). The Edit menu commands are described briefly in the next sections.

Cut

To use the Cut command, select the text to be deleted and then choose Cut from the Edit menu. The cut text will disappear from the screen and be placed in the Macintosh Clipboard.

The cut text remains in the Clipboard until you choose Cut or Copy again; this will replace whatever is stored in the Clipboard.

Copy

To use the Copy command, select the text to be copied and then choose Copy from the Edit menu. The copied text will remain on the screen, but a duplicate copy of it will be placed in the Macintosh Clipboard.

Paste

Use the Paste command to retrieve whatever text was most recently stored in the Macintosh Clipboard. Position the pointer where you want the text to appear, and then choose Paste from the Edit menu. The contents of the Clipboard will appear after the pointer.

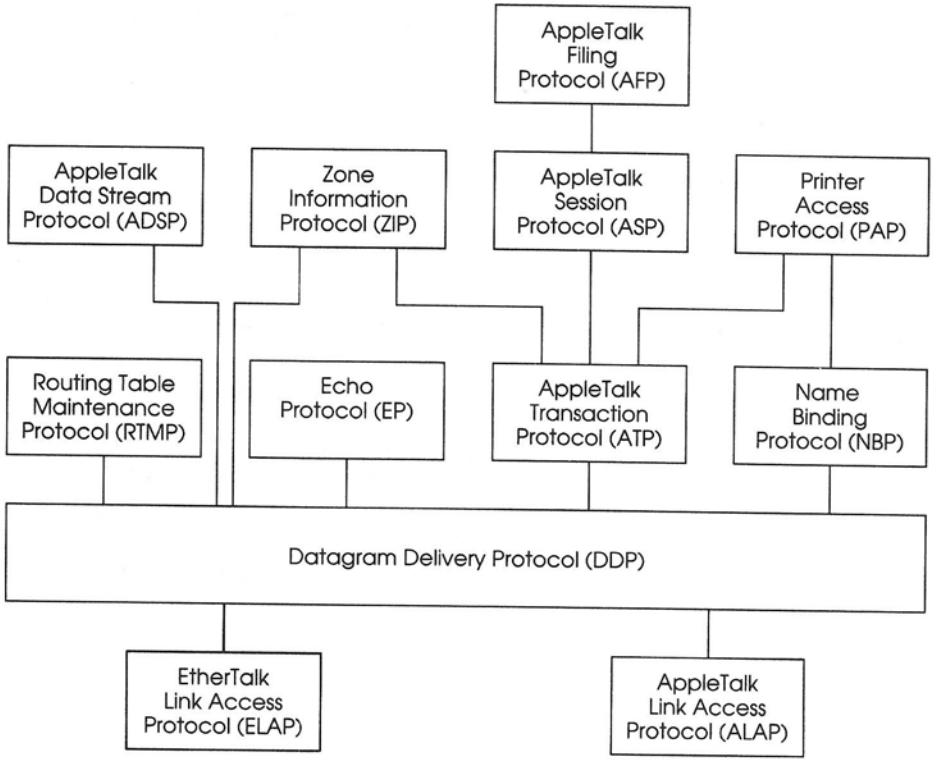
Appendix A

AppleTalk Protocols

This appendix is provided as a technical reference. Knowledge of AppleTalk protocol architecture is *not* required to understand or troubleshoot an AppleTalk network system. For more detailed information about AppleTalk protocols, see *Inside AppleTalk*.

The AppleTalk protocols discussed in the following sections represent standardized conventions by which data is transferred among AppleTalk-compatible devices. The various protocols are applied to packet addressing, routing, device naming, file access and transfer, and other key functions of network communication.

As illustrated in the following figure, multiple AppleTalk protocols are combined in a hierarchical arrangement, where higher-level protocols use lower-level protocols to realize network activity goals.


AppleTalk Filing Protocol (AFP)
AppleTalk Data Stream Protocol (ADSP)
Zone Information Protocol (ZIP)
AppleTalk Session Protocol (ASP)
Printer Access Protocol (PAP)
Routing Table Maintenance Protocol (RTMP)
Echo Protocol (EP)
AppleTalk Transaction Protocol (ATP)
Name Binding Protocol (NBP)
Datagram Delivery Protocol (DDP)
EtherTalk Link Access Protocol (ELAP)
AppleTalk Link Access Protocol (ALAP)

Link Access Protocol (LAP)

The primary function of a LAP is to manage node-to-node delivery of data on a single network. The particular LAP used depends on the cabling medium of the network.

On a LocalTalk network, ALAP (AppleTalk Link Access Protocol) controls network access, manages data encapsulation into AppleTalk formats called **frames,** controls frame transmission and reception, and provides device identification and network addressing mechanisms. ALAP is replaced by ELAP (EtherTalk Link Access Protocol) in EtherTalk networks.

Datagram Delivery Protocol (DDP)

DDP extends AppleTalk addressing beyond the node level through socket-to-socket delivery. This protocol defines internet addresses by socket number, node ID, and network number, and delivers data between individual sockets across an AppleTalk internet.

Data packets routed by DDP are called **datagrams.** DDP determines the destination address of datagrams and builds the appropriate address headers onto data packets, to enable routing through internet bridges as required.

Routing Table Maintenance Protocol (RTMP)

RTMP provides the routing information required by bridges to route datagrams through bridge ports toward destination networks. The key element used to accomplish this is the routing table resident in each bridge. RTMP dynamically maintains routing tables to reflect changes in internet topology, and periodically updates all table entries.

Echo Protocol (EP)

EP is implemented as an echoer process at a particular AppleTalk address. This means it can be used to determine if the designated address is accessible over the internet. EP is also useful in determining the time required for a packet to reach its destination.

Name Binding Protocol (NBP)

NBP enables AppleTalk protocols to understand user-defined zones and device names, by providing and maintaining translation tables that map these names to corresponding socket addresses.

AppleTalk Transaction Protocol (ATP)

An AppleTalk **transaction** takes place when a client of one socket transmits to another socket a request for which some response is required. (Generally, a status report or acknowledgment of the requested function is returned.) ATP manages this transaction in a way that binds the request and response together to ensure the reliable exchange of request/response pairs.

AppleTalk Session Protocol (ASP)

ASP provides a wider range of services than ATP for reliable transactions between higher-level protocols. This protocol can establish and maintain an AppleTalk **session** between two network resources. Within this session, a continuing exchange of AppleTalk transactions can take place between the participating devices.

Printer Access Protocol (PAP)

PAP manages interaction between workstations and print servers. This protocol handles connection setup, maintenance, and termination in addition to data transfer.

Zone Information Protocol (ZIP)

ZIP supports the AppleTalk zone feature by mapping zone names to corresponding network numbers. Zone Information Tables used in this function are implemented in all internet bridges and maintained by ZIP services.

AppleTalk Filing Protocol (AFP)

AFP allows dissimilar workstations to access a common file server. AFP supports Macintosh as well as MS-DOS, PC-DOS, and ProDOS® (Apple II family) system environments. This protocol is the file system language that governs shared access to the file server.

AppleTalk Data Stream Protocol (ADSP)

ADSP is a connection-oriented protocol providing a reliable, full-duplex, byte-stream service between any two sockets on an AppleTalk internet. It ensures in-sequence, duplicate-free delivery of data over its connections.

Appendix B

Network Configuration Guidelines

The guidelines that follow apply to planning a new network as well as modifying an existing one.

Network planning

The prime concern in laying out a network system will be to maintain a long-term outlook: Will the network you create today be flexible enough to serve your changing needs in the future? Here are some of the key concepts to consider:

- **Avoid uncontrolled growth:** Responsibility for network growth should be centralized with the network administrator. Users should not be permitted to add, remove, or relocate devices without consulting the network administrator.
- **Work toward a balanced network:** The placement of shared services, such as LaserWriters, will cause areas of high traffic concentration on the network. Be sure to locate printers and servers in a way that balances traffic.
- **Avoid unnecessary through traffic:** If one network is to require frequent access to one or more devices on another, be sure the networks are either contiguous or linked by a backbone. Otherwise, any networks placed between them will be bogged down carrying constant through traffic.

- **Use an orderly wiring scheme:** When the cabling system is not well organized, or cables from different networks are not clearly distinguished, tasks such as troubleshooting or adding nodes become confusing and error-prone. It's a useful practice to label all cables clearly.
- **Control the assignment of zones and device names:** Zones, network numbers, and device names should be kept consistent to facilitate network troubleshooting. Establish policies that centralize the planning and naming functions with the network administrator.

Efficient network layout

While every network is built to satisfy a different environment, some general guidelines can help optimize network layout. The sections that follow discuss the main considerations in designing an efficient network layout.

Analyze user traffic needs

LocalTalk hardware characteristics indicate a 32-node limit per single network; EtherTalk will support up to 254 nodes per network. Whether your situation will permit loading your network(s) to these limits, or expanding into an internet, will depend on the traffic generated by users.

The **usage level** of any user can be classed as low, medium, or high. While no restrictive cutoff levels are specified for number of nodes per type of use, the analysis of usage levels will help you to balance network traffic.

List users by level

Make a list of anticipated network users, showing the expected usage level and network function (applications used) of each user, as in the example that follows on the next page.

User	Function	Usage Level		
		Low	Med	High
Mary	Mail	x		
William	Mail, printing		x	
Antoine	Mail, file service, printing			x
Kelly	Mail, printing		x	
Steven	Shared database			x
Penny	Printing	x		
Bob	File service		x	

Once users have been classed by usage level, compare network groupings with this list to see which groups are most likely to generate high traffic. Use this analysis to design a balanced network layout and to assign network resources to users.

It would be unwise, for example, to group 32 high-usage workstations onto one network, unless the primary user function were file service or the network medium were EtherTalk. Likewise, it could be unnecessary and wasteful to break out 16 low-usage nodes into separate network segments with a bridge. A safe guideline is to consider 16–20 medium-usage nodes (for example, printing and file service functions) to constitute a full network.

❖ *Note:* It is good policy to *underload* networks in an initial internet design, since this will accommodate growth by adding to each network rather than creating additional networks.

Allocate network services

Once user traffic needs have been established, shared services such as LaserWriter printers and AppleShare file servers can be allocated for optimum efficiency. The location of a shared service should be selected to avoid unnecessary through traffic over networks that do not use the service.

The number of users sharing a single service will, once again, be dictated by usage levels. AppleShare file servers use Macintosh hard disks, and are therefore also subject to disk size limitations.

In allocating shared printers, consider such factors as LaserWriter output speed and the number and size of printing jobs. Printing requirements will be unique to your situation and cannot follow any preset guidelines.

Redundant routing

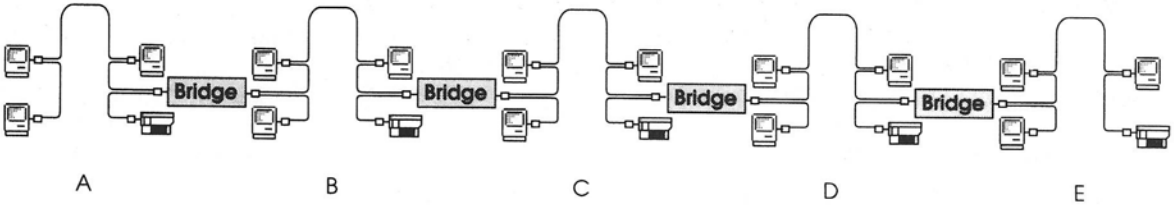
AppleTalk supports redundant routing in network system layouts. In this layout scheme, alternate paths are created between devices on an internet, providing a degree of fault tolerance in the event of a network break or bridge failure. Redundant routing requires an internet to contain at least two bridges, and to provide two or more routes between any two devices.

The backbone decision

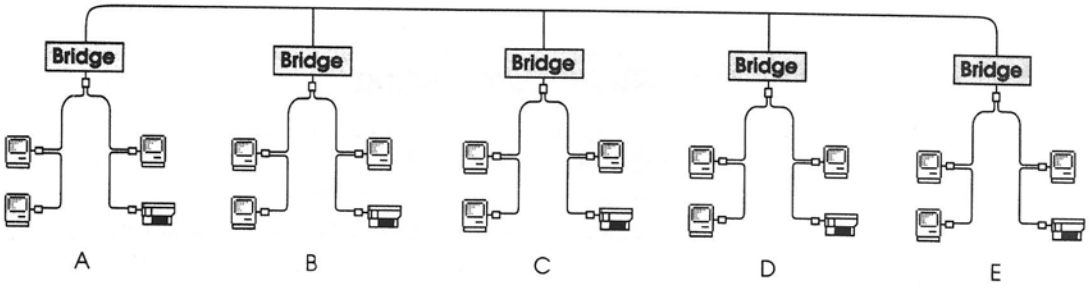
When constructing an internet, the use of a backbone configuration can provide for higher performance in two ways: network independence and transmission speed.

Network independence

Consider the internet diagram below. Should a break occur on network C, networks A and B would no longer be able to communicate with networks D and E. This is one of the weaknesses of a linear internet layout.



If a backbone is introduced into this configuration, each network can now access the balance of the internet independently of any other network. The backbone serves as the common link.



Transmission speed

The AppleTalk network architecture uses a set of protocols that are not dependent on any single cabling specification or speed. Several cabling options exist for both local segments and backbones. You can use one or more of these alternatives in an AppleTalk network system.

In a backbone internet that supports high internetwork traffic, a backbone cable medium with high bandwidth (throughput capacity), such as Ethernet, can significantly improve overall network speed.

The backbone medium decision will involve cost and building installation considerations, and will require specific bridge or gateway hardware and software support. Consult your authorized Apple dealer or representative for guidance.

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